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Evaluation of Water Quality Data - Blue Mountain Lake

James W. Moore
University of Arkansas, Fayetteville

Arkansas Water Resources Center

EVALUATION OF WATER QUALITY DATA BLUE MOUNTAIN LAKE

PREPARED FOR:

DEPARTMENT OF THE ARMY
LITTLE ROCK, DISTRICT, CORPS OF ENGINEERS
P.O. BOX 867
LITTLE ROCK, ARKANSAS 72203

PREPARED BY:

JAMES W. MOORE
PRINCIPAL INVESTIGATOR
DEPARTMENT OF CIVIAL ENGINEERING
UNIVERSITY OF ARKANSAS
FAYETTEVILLE, ARKANSAS 72701

ARKANSAS WATER RESOURCES
UNIVERSITY OF ARKANSAS
112 OZARK HALL
FAYETTEVILLE, ARKANSAS 72701

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Section I

SUMMARY AND CONCLUSIONS

Summary

This report includes a summary of the water quality information available for Blue Mountain Lake. Blue Mountain Lake is a multiple use project located on the Petit Jean River in west-central Arkansas. The lake is located in Logan and Yell Counties.

Petit Jean River Basin. The surface water resources in the Petit Jean River Basin include a variety of uses as designated by the Arkansas Department of Pollution Control and Ecology. With respect to the designated uses, Blue Mountain Lake is in the Arkansas River Valley Ecoregion. All of the surface water resources in the basin are designated as suitable for agricultural, municipal and industrial purposes. All are designated as suitable for secondary contact recreation. The streams in the Petit Jean River basin which have watersheds with areas greater than ten square miles and Blue Mountain Lake have been designated as suitable for primary contact recreation. Streams which have watersheds with areas greater than ten square miles are designated as suitable for Arkansas River Valley Ecoregion fisheries. Additionally, streams which have discharges equal to or exceeding one cubic foot per second are designated as perennial Arkansas River Valley Ecoregion fisheries even though the area of the drainage basin might be less than ten square miles. Streams in the Petit Jean River basin which have drainage basins with areas less than ten square miles are classified as seasonal Arkansas River Valley Ecoregion fisheries.

The applicable maximum temperatures are 31 ^{o}C (87.8 ^{o}F) and 32 ^{o}C (89.6 ^{o}F) for the streams and Blue Mountain Lake, respectively. The turbidity standard is 21 NTU for streams and 25 NTU for Blue Mountain Lake.

Blue Mountain Lake. For most of the parameters, the quality of the water in the lake is good. However, for certain parameters such as color, fecal coliform, iron, manganese, transparency and turbidity, the quality of the water in the lake was not very good. The water can be characterized as having small alkalinity, chloride, hardness and sulfate concentrations allowing the lake to be used as a raw water source for almost any purpose.

The quality of water with respect to most heavy metals was excellent. The concentrations of arsenic, copper, lead, mercury, nickel and zinc were all small. These concentrations were usually much below the level at which concern would be manifested. All were below the maximum contaminant levels for drinking water.

The iron concentrations have been large on occasion at the Petit Jean River, Waveland and Highway 109 sites. Iron data were not reported for the other three sampling sites. For example, the maximum iron concentrations at the Petit Jean River, Waveland and Highway 109 sites were 5,200, 6,600 and 5,000 micrograms per liter.

The manganese concentrations have also been large at times at the three sampling sites for which data were reported. The maximum concentrations were 1,700, 4,900 and 2,700 micrograms per liter for the Petit Jean River, Waveland and Highway 109 sites, respectively.

The aluminum concentrations were also much larger than in most lakes in western Arkansas. The maximum aluminum concentrations were 5,800, 4,700 and 3,800 micrograms per liter for the Petit Jean River, Waveland and Highway 109 sites.

The concentrations of fecal coliform bacteria were exceptionally large at times at several sites. For example, the maximum fecal coliform counts were 7,500, 6,000 and 9,000 colonies per 100 mL at the Highway 109, Sugar Grove and Narrows sites, respectively. Serious concern about these large fecal coliform counts must be expressed with respect to the safety of the water for primary contact recreation at times.

The transparency of the water was often much less than the desired value of forty-eight inches for water used for primary contact recreation. Although this value is not a mandatory requirement, it is usually considered to be the minimum for safety purposes. The color concentrations were very large on several occasions. They would have to be considered detrimental to the protection of aquatic life at times. The turbidity standards for the Petit Jean River site and most of the sites in the lake were exceeded on numerous occasions.

The turbidity values too often exceeded the standard of 25 NTU for the lake. Similarly, color concentrations often exceeded the rule of thumb concentration of 50 units.

Conclusions

1. The water in Blue Mountain Lake may be characterized as being of generally good quality which was usually suitable for the uses as designated by the Arkansas Department of Pollution Control and Ecology. These include primary and secondary contact recreation, the use of water for domestic, industrial and agricultural purposes, and for fisheries.

2. Continuation of the water quality monitoring and surveillance measures is essential to protect the designated uses of water from the lake. Particular attention should be directed at monitoring the fecal coliform, color, iron, manganese, chromium, turbidity, nutrient, chlorophyll a and chlorophyll b concentrations. More frequent monitoring of the fecal coliform concentrations by some agency is necessary to determine when the water at some of the sites is suitable for primary contact recreation.

3. The number and general location of sampling sites within the reservoir were well selected for most of the water quality parameters. However, the very large fecal coliform concentrations which have occurred at times suggest there are too few sampling sites with respect to this parameter.

The sampling sites for Blue Mountain Lake include: 1) a sampling site on the receiving stream which allows monitoring of the quality of the water being discharged from the lake (Petit Jean site); 2) a site in the main part of the lake upstream from the dam for which profile data for dissolved oxygen, temperature, pH and conductivity have been developed as well as data for other parameters (Waveland site); 3) a sampling site in the Ashley Creek area of the lake (Ashley Creek site); 4) a sampling site in the area where Highway 109 crosses the lake (Highway 109 site); 5) a site near Sugar Grove in the western part of the lake (Sugar Grove site), and; 6) a site near The Narrows in the northwestern part of the lake (Narrows site).

There is not much flexibility in adjusting the number of sampling sites because of the water quality problems with respect to certain parameters. Consequently, the recommendation is to retain all six sites. However, if it is absolutely necessary to eliminate a site, the only real possibility is the Highway 109 site. A realistic approach to monitoring requires that the receiving stream site (Petit Jean River site), the primary inlet stream (Narrows site) and a site upstream from the dam be maintained. The primary site in the lake upstream from the dam needs to be retained particularly to allow monitoring of the various parameters above and below the thermocline. The Ashley Creek site is needed to monitor the quality of the water in this part of the lake because of the Ashley Creek public use area. Elimination of both the Sugar Grove and Highway 109 sites would leave a large portion of the lake without water quality data being developed.

At this time, there is no apparent reason to move any of the sites. There were no water quality problems found which would suggest relocating a site to allow better monitoring. The existing sites allow monitoring of the principal inlet streams, the receiving stream and one site in the deepest part of the lake. This concept should be retained. It is clear that additional monitoring is required for certain parameters such as fecal coliform, color, iron, manganese, chromium, turbidity and transparency.

4. With respect to the types of analyses which should be conducted, the highest priority should be assigned to: 1) monitoring those parameters which are necessary to protect the designated uses of the water including those related to the safety of use of the water for primary contact recreation; 2) continued seasonal sampling of nitrogen, phosphorous, chlorophyll a, chlorophyll b, chloride, sulfate and fecal coliform; 3) monitoring activities above and below the thermocline at the Waveland site which is immediately upstream from the dam including the development of periodic profile data, and: 4) continued seasonal sampling for aluminum, color, dissolved oxygen, transparency, turbidity, five-day biochemical oxygen demand and pH.

Although monitoring water quality three times per year is adequate for most parameters, it clearly is not adequate for fecal coliform in this instance. The fecal coliform data which existed raise the question whether at least certain areas of the lake should have been used for primary contact recreation at times in the past. With just two samples per year (the May and August periods) during the time of the year when primary contact recreation occurs, it is not possible to estimate the length of time the high fecal coliform counts may have occurred.

5. Although providing background information, the frequency of sampling for several parameters which have small and/or relatively consistent concentrations could be reduced or eliminated. Conductivity, calcium, dissolved calcium, dissolved magnesium, total hardness and total alkalinity analyses could be conducted on annual basis.

Although they have not been conducted on a continuous basis at all sites, analyses for carbon dioxide, potassium, un-ionized ammonia nitrogen, ammonia nitrogen and Total Kjeldahl Nitrogen could be discontinued. Analyses for conductivity and pH for the profile data (Waveland Site) could be discontinued.

6. Priority should also be given to maintaining a complete record of the water quality at the Petit Jean River site downstream from the dam as this site provides information about the quality of the water being discharged to the river. At this site, particular emphasis should be maintained with respect to temperature, dissolved oxygen, five-day biochemical oxygen demand, color, pH, nitrogen, phosphorous, chloride, arsenic, chromium, copper, iron, lead, manganese, mercury, nickel and zinc and fecal coliform bacteria. Most of the existing heavy metals concentrations at this site were small. However, continued monitoring is

required to determine if any changes occur, particularly during the August and December periods.

Rather than discontinue sampling at one or more sites, or to reduce the number of analyses too severely, it is preferable to reduce the number of parameters for which analyses are conducted at the Highway 109 site where samples are collected at 0.2 and 0.8 depths. For example, samples for analyses for total alkalinity, chloride, total hardness, and sulfate could be collected at mid-depth rather than at the 0.2 and 0.8 depths. For some of the parameters, the concentrations at the two depths were different. However, the need for the analyses may not be critical. For example, total hardness, calcium, dissolved calcium and dissolved magnesium are important parameters. However, the concentrations of these parameters in the lake were so small that they would not influence the use of the water for any reasonable purpose.

7. The total alkalinity concentrations were usually quite small at the Petit Jean River site and the five sites in Blue Mountain Lake. An unusually large alkalinity concentration of 750 mg/L was reported at the Petit Jean River site. However, this seemed to be an anomaly rather than a reoccurring phenomena. It was some thirty times as large as any other alkalinity concentration reported. The total alkalinity concentrations were variable both seasonally and as function of time. They were also variable from site to site.

8. For the Petit Jean River site, the average seasonal five-day biochemical oxygen demand concentrations indicated some seasonal variation. The larger five-day biochemical oxygen demand concentrations occurred in the May period. This could be a reflection of the organic material being carried into the lake with the runoff occurring during the spring rainy season. The five-day biochemical oxygen demand concentrations generally were variable as a function of time. For all three seasons, the five-day biochemical oxygen demand concentrations would be considered about average for an impounded surface water.

All of the five-day biochemical oxygen demand concentrations were 2.9 mg/L, or less, at the Waveland site. The five-day biochemical oxygen demand concentrations were at levels which would be expected in a surface water resource. There was a trend for small seasonal variations.

The five-day biochemical oxygen demand concentrations were not remarkable at the Ashley Creek site and were representative of those expected in lakes in Arkansas. The minimum five-day biochemical oxygen demand concentrations were slightly larger than in some other lakes in Arkansas, but the concentrations were so small that these differences were subtle.

At the Highway 109 site, the maximum five-day biochemical oxygen demand concentration was 7.8 mg/L which was unusually large for a large lake in Arkansas. Although located in the same portion of the lake, the five-day biochemical oxygen demand data at the Sugar Grove site were more representative of that usually encountered in a large lake in Arkansas than the data for the Highway 109 site.

9. The chloride concentrations were very small at all six sampling sites in Blue Mountain Lake. Regulation No. 2 does not list a specific standard for the Petit Jean River. Consequently, the river would be covered under the general clause allowing an increase up to 15 mg/L or an increase of one-third over the naturally occurring levels whichever is greater. The increase cannot cause the concentrations to exceed 250 mg/L. Since the natural levels are small, the allowable increase would be up to 15 mg/L. In any case, the chloride concentrations would be considered very small. The chloride concentrations varied somewhat as a function of the season of the year, as a function of time and from site to site.

10. The average chlorophyll a concentrations were variable as a function of time, as a function of the season of the year and from site to site among the five sampling sites in the lake. The chlorophyll a concentrations were large at four of the five sites in the lake at times. The maximum concentrations were 28.0, 41.0, 33.0, 9.0 and 27.9 micrograms per liter, respectively, at the Waveland, Ashley Creek, Highway 109, Sugar Grove and Narrows sites. A lake in the mesotrophic stage would usually have chlorophyll a concentrations from 2 to 15 micrograms per liter.

The average chlorophyll a concentrations were largest in the August period at all five sites. They were smallest in the December period at all of the sites. The average chlorophyll a concentrations varied considerably from site to site. For example, the average concentrations ranged from 3.9 micrograms per liter at the Sugar Grove site to 17.1 micrograms per liter at the Highway 109 site.

The chlorophyll b concentrations were also variable as a function of time, as a function of the season of the year and from site to site. The concentrations were relatively large on several occasions. The maximum concentrations were 4.0, 2.0, 3.0, 0.5 and 3.3 micrograms per liter, respectively, at the Waveland, Ashley Creek, Highway 109, Sugar Grove and Narrows sites. The chlorophyll b concentrations were largest in the August periods at all five sites. They were smallest in the December period at all of the sites. The average concentrations ranged from 0.2 microgram per liter at the Sugar Grove site to 1.7 micrograms per liter at the Narrows site in the August period.

11. The color concentrations were very large on a number of occasions in Blue Mountain Lake. The maximum concentrations were 1,500, 1,600, 120, 230, 100 and 180 units, respectively, at the Petit Jean River, Waveland, Ashley Creek, Highway 109, Sugar Grove and Narrows sites. For reference purposes, the rule of thumb value for the protection of aquatic life is 50 units. The average color concentrations were larger than 50 units for at least one of the seasonal periods at the Petit Jean River, Waveland, Ashley Creek, Highway 109 and Narrows sites. At the Petit Jean River and Waveland sites, the average color concentrations exceeded 50 units in both the May and August seasonal peri-

ods. The average concentrations exceeded 50 units at the Ashley Creek sites in the May and December periods. The average concentrations exceeded 50 units in the December period at the Highway 109 and Narrows sites.

The average color concentrations exceeded 25 units for all three seasonal periods at all of the five sites in the lake. Clearly, the color concentrations need to be evaluated with respect to the source and the remedial action which might be taken.

12. The conductivity values were relatively small at all six sites for Blue Mountain Lake. The largest average conductivity values usually occurred in the August period. The largest average concentration was 100 micromhos per centimeter which occurred in the August period at the Narrows site. The conductivity values were variable as a function of time, as a function of the season of the year and from site to site.

The average conductivity values ranged from 38 micromhos per centimeter at the Sugar Grove site to 85 micromhos per centimeter at the Narrows site in the December period. The conductivity values varied considerably as a function of time.

13. At the Petit Jean River site, the dissolved oxygen concentrations were less than the stream standard of 5 mg/L on only one occasion. Consequently, the dissolved oxygen concentrations should be considered good. The general trend was for the dissolved oxygen concentrations to remain relatively constant as a function of time for all three seasonal

periods. Except for one sample containing 2.8 mg/L of dissolved oxygen, all of the samples collected in the May period at the Ashley Creek site had excellent dissolved oxygen concentrations. Most contained 8.0 mg/L or more of dissolved oxygen. In the August period, three of the twelve samples had dissolved oxygen concentrations less than 6.0 mg/L. At the Highway 109 site, the dissolved oxygen concentrations in the August data were adversely affected by the stratification occurring in the lake at this site. On occasion, the dissolved oxygen concentrations in the samples collected at the two depths were substantially different in the May period. Usually, however, the two concentrations were about the same. The data are variable in the August period at the Highway 109 site for the samples collected at 0.2 depth. For the samples collected at 0.8 depth, the dissolved oxygen concentrations were relatively small. At the Sugar Grove site, the dissolved oxygen concentrations were larger during the December period than in the May and August periods and were larger in the May period than in the August period. The dissolved oxygen concentrations were nearly constant in the August period at the Sugar Grove site.

14. Blue Mountain Lake and the Petit Jean River are designated as primary contact waters. Consequently, the applicable standard based on Regulation No. 2 is a geometric mean of 200 colonies per 100 mL for the period between April 1 and September 30. Additionally, the fecal coliform count shall not exceed 400 colonies per 100 mL in more than 10 percent of the samples in any one month.

The fecal coliform counts were well within acceptable levels at the Waveland site. The maximum fecal coliform count at this site was 140 mg/L.

At the Ashley Creek site, three fecal coliform counts were relatively large. These were 700 colonies per 100 mL in the May period of 1984, 1,100 colonies per 100 mL in the December period in 1980 and 280 colonies per 100 mL in the May period of 1986. These concentrations are troublesome. Fortunately, however, the fecal coliform counts in recent years have been quite small and well within the standards for primary contact recreation. Additionally, the data for the December period indicated a generally decreasing trend for fecal coliform since 1987.

The fecal coliform concentrations in the lake at the Highway 109 site were large on two occasions in the May period and on three occasions in the December period. The maximum concentration was 7,500 colonies per 100 mL which indicated a contaminated water with respect to this parameter. A second peak of 700 colonies per 100 mL occurred in 1989 in the May period. The three largest fecal coliform counts in the December period were 5,800 in 1980, 1,700 in 1983 and 1,400 in 1985. The fecal coliform counts exceeded 200 colonies per 100 mL in the May period on five occasions. Although the tendency for large fecal coliform counts did not occur each year, it is obviously of concern.

At the Sugar Grove site, the peak fecal coliform count occurred in August, 1986. This peak concentration was 6,000 colonies per 100 mL which indicated a water of poor quality with respect to this parameter. A secondary peak also occurred in 1984 in the May period. This concentration was 530 colonies per 100 mL. The fecal coliform counts since 1986 have been small and well within acceptable levels in the May period. The coliform counts for the August period were less than the standard for primary contact recreation. However, the peak coliform count was 1,600 colonies per 100 mL in the December period. This count occurred in 1984. Two secondary peaks of 430 and 470 colonies per 100 mL also occurred during the December period. These were in 1985 and 1980, respectively.

The maximum coliform count at the Narrows site was 9,000 colonies per 100 mL. This coliform concentration was very large. Six of the thirteen fecal coliform counts reported in the May period were larger than 200 colonies per 100 mL. One of the remaining seven counts was 200 colonies per 100 mL. Consequently, the fecal coliform counts are of considerable concern in the May period. Fortunately, the general tendency has been for smaller fecal coliform counts during the past four years. The peak concentration of 1,300 colonies per 100 mL in the December period occurred in 1985 and was sufficiently large to cause concern.

15. The total hardness concentrations in the samples collected were relatively small at all six sampling sites. The total hardness concentrations varied as a function of time, as a function of the season of the year and from site to site. For example, the average total hardness concentrations ranged from 10 mg/L at the Sugar Grove site to 32 mg/L

at the Highway 109 site in the August period. As an example of the variation as a function of the season of the year, the average concentrations were 16, 32 and 19 mg/L for the three seasonal periods at the Highway 109 site.

The calcium concentrations were variable as a function of time, as a function of the season of the year and from site to site. For example, the average concentrations were 8, 19 and 9 mg/L at the Highway 109 site for the three seasonal periods. The average concentrations ranged from 6 mg/L at the Sugar Grove site to 19 mg/L at the Highway 109 site in the August period.

The dissolved calcium concentrations were usually more uniform. They were variable as a function of time, as a function of the season of the year and from site to site. The average concentrations were usually less than 5 mg/L for all three seasonal periods. However, the average concentration was 7 mg/L at the Highway 109 site in the August period.

The dissolved magnesium concentrations were small and relatively uniform at all six sites. The largest average concentration was 3.8 mg/L which occurred in the December period at the Ashley Creek site.

16. The aluminum concentrations were large on occasion at each of the three sites for which aluminum analyses were conducted. The three sites were the Petit Jean River, Waveland and Highway 109 sites. The maximum concentration at the Petit Jean River site was 5,800 micrograms per liter. This was an unusually large aluminum concentration in sur-

face waters in Arkansas. There is no maximum contaminant level for aluminum in drinking water. Similarly, there is no stream standard for aluminum. The maximum concentrations were 4,700 and 3,800 micrograms per liter at the Waveland and Highway 109 sites. Neither of these concentrations occurred in the seasonal periods. The aluminum concentrations were variable as a function of time, as a function of the season of the year as from site to site. The average seasonal concentrations were 330, 910 and 210 micrograms per liter for the three seasonal periods at the Petit Jean River site.

The maximum arsenic concentration was 8 micrograms per liter in the record. This concentration occurred at the Petit Jean River and Waveland sites. For reference purposes, the maximum contaminant level for arsenic in drinking water is 50 micrograms per liter. All of the arsenic concentrations were much below the maximum contaminant level for drinking water and were well within the acceptable range for the protection of aquatic life.

The maximum chromium concentrations were 30, 40 and 30 micrograms per liter at the Petit Jean River, Waveland and Ashley Creek sites. The maximum contaminant level for chromium in drinking water is 50 micrograms per liter. Chromium concentrations exceeding 10 to 15 micrograms per liter may be detrimental to aquatic life. Consequently, the chromium concentrations were larger than desirable on occasion at each of the sampling sites.

The copper concentrations were very small at the three sites for which analyses were conducted. The maximum copper concentration was 20 micrograms per liter which is well within acceptable levels for the protection of aquatic life and for use as a water supply source.

The iron concentrations were very large on several occasions. The maximum iron concentrations were 16,000, 33,000 and 5,000 micrograms per liter at the Petit Jean River, Waveland and Ashley Creek sites. The average seasonal concentrations were 1,370, 1,145 and 1,665 micrograms per liter in the August period at the Petit Jean River, Waveland and Ashley Creek sites. At the Highway 109 site, the average seasonal concentrations were 1,390, 1,665 and 2,700 micrograms per liter for the three seasonal periods. At the Ashley Creek site, the average seasonal concentrations were 1,080, 1,145 and 755 micrograms per liter. The average concentrations were 980, 1,370 and 710 micrograms per liter at the Petit Jean River site. These were unusually large iron concentrations. For reference purposes, the recommended maximum contaminant level for drinking water is 300 micrograms per liter. There was considerable seasonal variation in the iron concentrations. The iron concentrations also varied substantially from time to time.

The maximum lead concentration found in the record was 57 micrograms per liter which occurred at the Petit Jean River site. Relative to lead concentrations usually found in other lakes in Arkansas, the 57 micrograms per liter was large.

The manganese concentrations were also large at times in the lake. The maximum concentrations were 1,700, 4,900 and 2,700 micrograms per liter at the Petit Jean River, Waveland and Ashley Creek sites. The average concentrations were 170, 1,060 and 150 micrograms per liter at the Petit Jean River site. At the Waveland site, the average concentrations were 285, 1,245 and 140 micrograms per liter. The average concentrations were 180, 510 and 225 micrograms per liter at the Ashley Creek site. As indicated by these concentrations, the manganese concentrations were variable as a function of the season of the year and from site to site.

The mercury concentrations at the three sites for which analyses were conducted were usually small. The maximum mercury concentration was 2.7 micrograms per liter. This mercury concentration is large in the context of the protection of aquatic life. However, all of the other mercury concentrations were well within acceptable levels at the three sites.

The nickel concentrations were all within acceptable levels for the protection of aquatic life. The maximum concentrations were 7, 16 and 12 micrograms per liter at the Petit Jean River, Waveland and Ashley Creek sites. The nickel data were variable as a function of time, as a function of the season of the year and from site to site.

The zinc concentrations were usually within acceptable levels for the protection of aquatic life. However, the maximum concentrations at the Waveland and Ashley Creek sites approached the upper limit of the desirable range. The zinc concentrations were usually much smaller.

17. All of the un-ionized ammonia nitrogen concentrations were less than the EPA criterion of 0.02 mg/L for the protection of aquatic life. The maximum un-ionized ammonia concentration in the record was 0.0020 mg/L which occurred at the Petit Jean River and Waveland sites. Although the un-ionized ammonia concentrations were larger than those encountered in other lakes, they were within acceptable levels.

The ammonia nitrogen concentrations varied considerably as a function of time, as a function of the season of the year and from site to site. For example, the average concentrations ranged from 0.09 mg/L at the Highway 109 site to 0.31 mg/L at the Sugar Grove site. The maximum concentrations were 0.33, 0.40 and 0.32 mg/L at the Petit Jean River, Waveland and Ashley Creek sites.

The nitrate concentrations varied considerably from site to site. For example, the average concentrations ranged from 0.06 mg/L at the Sugar Grove site to 0.21 mg/L at the Highway 109 site in the August period. In the May period, the average concentrations ranged from 0.08 mg/L at the Waveland, Ashley Creek and Sugar Grove sites to 0.15 mg/L at the Narrows site. The nitrate concentrations were significantly larger in the December period at the Narrows, Highway 109 and Ashley Creek sites. The nitrate concentrations also varied as a function of time and as a function of the season of the year. The average concentrations for the three seasonal periods were 0.15, 0.09 and 0.23 mg/L at the Narrows site. A peak concentration of 2.60 mg/L occurred in the August period at the Highway 109 site. This was a remarkably large nitrate concentration.

The Total Kjeldahl Nitrogen concentrations varied somewhat among the seasons of the year. For example, the average Total Kjeldahl Nitrogen concentrations were 0.52, 0.78 and 0.63 mg/L for the three seasonal periods at the Waveland site. They also varied from site to site. The average Total Kjeldahl Nitrogen concentrations ranged from 0.78 mg/L at the Waveland site to 0.89 mg/L at the Highway 109 site in the August period. The maximum concentration in the record was 2.30 mg/L which occurred in the August period at the Highway 109 site.

The total nitrogen concentrations also varied as a function of time, as a function of the season of the year and from site to site. For example, the average total nitrogen concentrations ranged from 0.92 mg/L at the Petit Jean River site to 2.40 mg/L at the Highway 109 site in the August period. With respect to the season of the year, the average concentrations were 0.95, 1.40 and 1.02 mg/L at the Highway 109 site.

18. The pH values at all six sites for Mountain Lake were usually within the limits established by the Arkansas Department of Pollution and Control in Regulation No. 2. The minimum pH values were 2.26, 5.80 and 5.92 units at the Waveland, Highway 109 and Sugar Grove sites. These were less than the minimum limit established by Regulation Number

2. However, the pH value of 2.26 units was questionable. Also, the samples collected at the Highway 109 site were collected at two depths. The minimum pH value occurred in the sample collected at 0.8 depth. All of the samples collected at 0.2 depth had pH values larger than 6.0 units. Thus, there was little concern with respect to the pH of the water in Blue Mountain Lake.

19. The total phosphorous concentrations were large at several of the sites. For reference purposes, the total phosphorous concentrations in large lakes are usually in the range of from 0.01 to 0.05 mg/L. The average concentrations equalled or exceeded the upper end of this range at several sites. The average concentrations were 0.07, 0.09 and 0.04 mg/L, respectively, in the May, August and December periods at the Petit Jean River site. At the Waveland site, the average concentrations were 0.05, 0.11, and 0.04 mg/L for the three seasonal periods. The average concentrations were 0.07, 0.06 and 0.05 mg/L at the Ashley Creek site and 0.05, 0.06 and 0.06 mg/L at the Highway 109 site. The average concentrations were larger at the Narrows site. They were 0.08, 0.21 and 0.06 mg/L, respectively, in the May, August and December seasonal periods. The Sugar Grove site was the only site which had total phosphorous concentrations in the usual range for large unpolluted lakes. The average concentrations were 0.02, 0.02 and 0.03 mg/L for the three seasonal periods. The maximum concentrations were very large at times. For example, the maximum concentrations were 1.60 and 1.10 mg/L at the Waveland and Narrows sites, respec-

tively. Both of these occurred in the August period. Clearly, there was too much phosphorous in the lake. The total phosphorous concentrations varied as a function of time, as a function of the season of the year and from site to site.

The orthophosphate concentrations were also relatively large at the Waveland, Ashley Creek and Narrows sites. The average concentrations were 0.03, 0.07 and 0.02 mg/L at the Petit Jean River site. The orthophosphate concentrations were inconsistent with respect to variation as a function of the season of the year. As indicated, they varied considerably at the Petit Jean River site. However, the average concentrations for the three seasonal periods were constant at the Sugar Grove and Ashley Creek sites and were nearly so at the Highway 109 site. They did vary from site to site.

20. All of the sulfate concentrations were relatively small for Blue Mountain Lake and the Petit Jean River sites. The maximum sulfate concentration in the record was 15 mg/L. It occurred at the Petit Jean River site. Regulation No. 2 does not contain a specific stream standard for sulfate in the Petit Jean River. Consequently, the allowable sulfate concentrations in the river fall under the general requirement that an increase up to 15 mg/L, or an increase of one-third over naturally occurring levels, whichever is greater, may be permitted. In no case, however, may discharges cause concentrations in the tributary streams to exceed 250 mg/L. The recommended maximum contaminant level for sulfate in drinking water is 250 mg/L. Consequently, all of the sul-

fate concentrations were less than the applicable standard for the Petit Jean River. There were only nominal variations with respect to the season of the year, as a function of time and from site to site.

21. The transparency values for the five sites in Blue Mountain Lake were usually less than desirable at all five sites in Blue Mountain Lake. The recommended minimum transparency value is usually forty-eight inches for primary contact recreation. This value allows good visibility in the water. The average transparency values were all less than the recommended minimum.

The average seasonal transparency values were 22, 21 and 24 inches, respectively, in the May, August and December seasonal periods at the Waveland site. At the Ashley Creek site, the average values were 18, 11 and 24 inches for the three seasonal periods. They were 20, 26 and 28 inches at the Highway 109 site and 19, 26 and 8 at the Sugar Grove site. At the Narrows site, the average transparency values were 15, 15 and 19 inches. At several of the sites, the maximum transparency values were usually, or all, less than the recommended minimum of forty-eight inches. Clearly, the water usually does not have good clarity in Blue Mountain Lake.

22. The turbidity standard for Blue Mountain Lake is 25 NTU. The turbidity values frequently exceeded this standard at some of the sites in the lake. For the Petit Jean River, the specific standard is 21 NTU.

The turbidity values exceeded the stream standard on numerous occasions. Eight of the thirteen turbidity values reported in the May period equalled or exceeded the standard at the Petit Jean River. The data in the August period were much more constant. Three of the turbidity values in the August period exceeded the stream standard. Although variable, the turbidity values in the December period were usually smaller than in the May period. Only two of the eight values exceeded the stream standard.

Twelve of the thirty samples collected in the May period at the Waveland site had turbidity values equal to or exceeding 25 FTU. However, eight of the twelve were in the samples collected at 0.8 depth. The maximum turbidity in the samples collected at 0.2 depth was 46 FTU. For the August period, only two of nineteen observations exceeded the standard for Blue Mountain Lake. Both were in samples collected at 0.8 depth. In the December period, four of the twenty observations exceeded 25 FTU. Two of these were in the samples collected at 0.2 depth.

At the Ashley Creek site, the standard of 25 NTU was exceeded in all three seasonal periods. For example, five of the fourteen turbidity values reported in the May period exceeded 25 FTU. Two of the eleven values in the August period equalled or exceeded 25 FTU. Three of the ten values in the December period exceeded the specific standard for turbidity.

At the Highway 109 site, eleven of the twenty-six turbidity values in the May period equalled or exceeded the standard of 25 NTU. The largest turbidity values were 62 and 50 FTU which occurred in the samples collected at the 0.2 and 0.8 depths, respectively, in the May 1986 period. Five of the twenty turbidity values reported in the August period equalled or exceeded the turbidity standard for Blue Mountain Lake. The maximum turbidity value in the August period was 31 FTU. The maximum turbidity value for the December period was 300 FTU which was very large. This turbidity value occurred in the sample collected at 0.8 depth in 1980. The turbidity value in the sample collected at 0.2 depth at the same time was 150 units which was also relatively large.

At the Narrows site, the turbidity values in the May period frequently exceeded the standard of 25 NTU for Blue Mountain Lake. Seven of the twelve values reported for this site were larger than the limit of 25 FTU. In the August period, four of the eleven values reported were larger than 25 FTU. Two of the ten values reported in the December period were larger than 25 FTU.

The turbidity values in Blue Mountain Lake and in the Petit Jean River are frequently larger than desirable. They undoubtedly contribute to the reduced transparency in the lake.

Section II

BACKGROUND

Water Quality

Water quality requirements are basically determined by the use, or proposed use, of the water. Consequently, there are a variety of scales by which the quality of a water can be measured. The single most applicable scale for Blue Mountain Lake is Regulation No. 2 issued by the Arkansas Department of Pollution Control and Ecology. Regulation No. 2 established water quality standards for surface waters in the State of Arkansas. It contains both guidelines and standards for a variety of parameters. A second scale includes the drinking water regulations promulgated by the Environmental Protection Agency. These contain both mandatory and recommended maximum contaminant levels for a variety of parameters.

Water Quality Standards for Surface Waters in Arkansas

Regulation No. 2 contains provisions for both streams and lakes. Since the water quality monitoring program for Blue Mountain Lake includes stations both in the lake and downstream from the lake, a brief discussion of each is appropriate. The provisions included in Regulation No. 2 include both general and specific standards. The specific standards applicable for a particular stream are a function of the designated waterbody use for that stream.

Waterbody Uses. The designated waterbody uses are defined in Regulation No. 2 as follows:

Extraordinary Resource Waters-This beneficial use is a combination of the chemical, physical and biological characteristics of a waterbody and its watershed which is characterized by scenic beauty, aesthetics, scientific values, broad scope recreation potential and intangible social values.

Ecologically Sensitive Waterbody-This beneficial use identifies segments known to provide habitat for threatened, endangered or endemic species of aquatic or semi-aquatic life forms.

Natural and Scenic Waterways-This beneficial use identifies segments which have been legislatively adopted into a state or federal system.

Primary Contact Recreation-This beneficial use designates waters where full body contact is involved. Any streams with watersheds of greater than 10 square miles are designated for full body contact. All streams with watersheds less than 10 square miles may be designated for primary contact recreation after site verification.

Secondary Contact Recreation-This beneficial use designated waters where secondary activities like boating, fishing or wading are involved.

Fisheries-This beneficial use provides for the protection and propagation of fish, shellfish and other forms of aquatic life. It is further subdivided into the following subcategories:

1) Trout - water which is suitable for the growth and survival of trout (Family: Salmonidae).

2) Lakes and Reservoirs - water which is suitable for the protection and propagation of fish and other forms of aquatic life adapted to impounded waters. Generally characterized by a dominance of sunfishes such as bluegill or similar species, black basses and crappie. May include substantial populations of catfishes such as channel, blue and flathead catfish and commercial fishes including carp, buffalo and suckers. Forage fishes are normally shad or various species of minnows. Unique populations of walleye, striped bass and/or trout may also exist.

3) Streams - water which is suitable for the protection and propagation of fish and other forms of aquatic life adapted to flowing water systems whether or not the flow is perennial.

   a) Ozark Highlands Ecoregion - Streams supporting diverse communities of indigenous or adapted species of fish and other forms of aquatic life. Fish communities are characterized by a preponderance of sensitive species and normally dominated by a diverse minnow community followed by sunfishes and darters. The community may be generally characterized by the following fishes:

Key Species	Indicator Species
Duskystripe shiner	Banded sculpin
Northern hogsucker	Ozark madtom
Slender madtom	Southern redbelly dace
"Rock" basses	White tail
Rainbow and/or Orangethroat darters	Ozark minnow
Smallmouth bass	

b) Boston Mountains Ecoregion - Streams supporting diverse communities of indigenous or adapted species of fish and other forms of aquatic life. Fish communities are characterized by a major proportion of sensitive species; a diverse, often darter-dominated community exists but with nearly equal proportions of minnows and sunfishes. The community may be generally characterized by the following fishes:

Key Species	Indicator Species
Bigeye shiner	Shadow bass
Black redhorse	Wedgespot shiner
Slender madtom	Longnose darter
Longear sunfish	Fantail darter
Greenside darter	
Smallmouth bass	

c) Arkansas River Valley Ecoregion - Streams supporting diverse communities of indigenous or adapted species of fish and other forms of aquatic life. Fish communities are characterized by a substantial proportion of sensitive species; a sunfish- and minnow-dominated community exists but with substantial proportions of darters and catfishes (particularly madtoms). The community may be generally characterized by the following fishes:

Key Species	Indicator Species
Bluntnose minnow	Orangespotted sunfish
Golden redhorse	Blackside darter
Yellow bullhead	Madtoms
Longear sunfish	
Redfin darter	
Spotted bass	

d) Ouachita Mountains Ecoregion - Streams supporting diverse communities of indigenous or adapted species of fish and other forms of aquatic life. The fish community is characterized by a major proportion of sensitive species; a sunfish-and minnow-dominated community exists but with substantial proportions of darters and catfishes (particularly madtoms). The community may be generally characterized by the following fishes:

Key Species	Indicator Species
Bigeye shiner	Shadow bass
Northern hogsucker	Gravel chub
Freckled madtom	Northern studfish
Longear sunfish	
Orangebelly darter	
Smallmouth bass	

e) Typical Gulf Coastal Ecoregion - Streams supporting diverse communities of indigenous or adapted species of fish and other forms of aquatic life. Fish communities are characterized by a limited proportion of sensitive species; sunfishes are distinctly dominant followed by darters and minnows. The community may be generally characterized by the following fishes:

Key Species	Indicator Species
Redfin shiner	Pirate perch
Spotted sucker	Warmouth
Yellow bullhead	Spotted sunfish
Flier	Dusky darter
Slough darter	Creek chubsucker
Grass pickerel	Banded pygmy sunfish

f) Springwater-influenced Gulf Coastal Ecoregion - Streams supporting diverse communities of indigenous or adapted species of fish and other forms of aquatic life. Fish communities are characterized by a substantial proportion of sensitive species; sunfishes normally dominate the community and are followed by darters and minnows. The community may be generally characterized by the following fishes:

Key Species	Indicator Species
Redfin shiner	Pirate perch
Blacktail redhorse	Golden redhorse
Freckled madtom	Spotted bass
Longear sunfish	Scaly sand darter
Creole darter	Striped shiner
Grass pickerel	Banded pygmy sunfish

g) Least-altered Delta Ecoregion - Streams supporting diverse communities of indigenous or adapted species of fish and other forms of aquatic life. Fish communities are characterized by an insignificant proportion of sensitive species; sunfishes are distinctly dominant followed by minnows. The community may be generally characterized by the following fishes:

Key Species	Indicator Species
Ribbon shiner	Pugnose minnow
Smallmouth buffalo	Mosquitofish
Yellow bullhead	Pirate perch
Bluegill	Tadpole madtom
Bluntnose darter	Banded pygmy sunfish
Largemouth bass	

h) Channel-altered Delta Ecoregion - Streams supporting diverse communities of indigenous or adapted species of fish and other forms of aquatic life. Fish communities are characterized by an absence of sensitive species; sunfishes and minnows dominate the population followed by catfishes. The community may be generally characterized by the following fishes:

Key Species	Indicator Species
Blacktail shiner	Mosquitofish
Drum	Gizzard shad
Carp	Emerald shiner
Channel catfish	
Green sunfish	
Spotted gar	

Domestic Water Supply-This beneficial use designates water which will be protected for use in public and private water supplies. Conditioning or treatment may be necessary prior to use.

Industrial Water Supply-This beneficial use designates water which will be protected for use as process or cooling water. Quality criteria may vary with the specific type of process involved and the water supply may require prior treatment or conditioning.

Agricultural Water Supply-This beneficial use designates waters which will be protected for irrigation of crops and/or consumption by livestock.

Other Uses-This category of beneficial use is generally used to designate uses not dependent on water quality, such as hydroelectric power generation and navigation.

General Standards. The general standards are applicable to all surface waters of the State at all times. They are specifically applicable to substances attributed to discharges, nonpoint sources of instream activities rather than natural occurrences. The criteria do not apply to waters which have natural background levels of certain substances which exceed the limits. The general standards include the provision that all waters shall be free from substances attributed to man-caused point or nonpoint source discharges in concentrations that produce undesirable aquatic life or result in the dominance of nuisance species. Included also in the provision that true color shall not be increased in any waters to the extent that it will interfere with present or projected future uses of these waters. A third provision is that taste and odor producing substances shall be limited in receiving waters to concentrations that will not interfere with the production of potable water by reasonable water treatment processes, or impart unpalatable flavor to food, fish or result in offensive odors arising from the waters or otherwise interfere with the reasonable use of the water. A fourth provision is that receiving waters shall have no distinctly visible solids, scum or foam of a persistent nature, nor shall there be any formation of slime, bottom deposits or sludge banks.

Specific Standards. Regulation No. 2 requires that the following specific standards shall apply at all times except during periods when flows are less than the average minimum 7-day flow which occurs once in ten years (Q7-10). Streams with regulated flow will be addressed on a case-by-case basis to maintain designated instream uses. These standards apply outside the mixing zone to conditions resulting in frequent, persistent or long-term modification of the water quality and are not applicable to naturally-occurring excursions outside the standards.

> Temperature-Heat shall not be added to any waterbody in excess of the amount that will elevate the natural temperature, outside the mixing zone, by more than 5 ^{o}F (2.8 ^{o}C) based upon the monthly average of the maximum daily temperatures measured at mid-depth or three feet (whichever is less) in streams, lakes or reservoirs. Maximum allowable temperatures from man-induced causes in the following waters are shown in Table I. Temperature requirements shall not apply to off-stream privately-owned reservoirs constructed primarily for industrial cooling purposes and financed in whole or in part by the entity or successor entity using the lake for cooling purposes.
>
> Turbidity - There shall be no distinctly visible increase in turbidity of receiving waters attributable to municipal, industrial, agricultural, other waste discharges or instream activities. Specifically, in no case shall any such waste discharge or instream activity cause turbidity values to exceed those shown in Table II.

Table I

Maximum Allowable Temperatures
From Man-Induced Causes
For Waters in Arkansas

Waterbodies	Limit °C (°F)
Streams	
Ozark Highlands	29 (84.2)
Boston Mountains	31 (87.8)
Arkansas River Valley	31 (87.8)
Ouachita Mountains	30 (86.0)
Gulf Coastal	30 (86.0)
Least-Altered Delta	30 (86.0)
Channel-Altered Delta	32 (89.6)
White River (Dam #1 to mouth)	32 (89.6)
St. Francis River	32 (89.6)
Mississippi River	32 (89.6)
Arkansas River	32 (89.6)
Ouachita River (L. Missouri R. to state line)	32 (89.6)
Red River	32 (89.6)
Lakes and Reservoirs	32 (89.6)
Trout waters	20 (68.0)

Table II

Maximum Allowable Turbidity Values
From Man-Induced Causes
For Waters in Arkansas

Waterbodies	Limit (NTU)
Streams	
Ozark Highlands	10
Boston Mountains	10
Arkansas River Valley	21
Ouachita Mountains	10
Gulf Coastal	21
Least-Altered Delta	45
Channel-Altered Delta	75
Arkansas River	50
Mississippi River	50
Red River	50
St. Francis River	75
Trout	10
Lakes and Reservoirs	25

<u>pH</u> - As a result of waste discharges, the pH of water in streams or lakes must not fluctuate in excess of 1.0 unit over a period of 24 hours and pH values shall not be below 6.0 or above 9.0.

<u>Dissolved Oxygen</u> - In streams with watersheds of less than 10 mi^2, it is assumed that insufficient water exists to support a fishery during the critical season. During this time, a D.O. standard of 2 mg/L will apply to prevent nuisance conditions. However, field verification is required in areas suspected of having significant groundwater flows which may support unique aquatic biota. All streams with watersheds of less than 10 mi^2 are expected to support a fishery during the primary season when stream flows, including discharges, equal or exceed 1 cubic foot per second (CFS); however, when site verification indicates that a fishery exists at flows below 1 CFS such fishery will be protected by the appropriate standard. During the period when a fishery exists in these streams with watersheds of less than 10 mi^2, the primary season D.O. standard will apply. Also, in these streams where waste discharges are 1 CFS or more, they are assumed to provide sufficient water to support a perennial fishery and, therefore, must meet the dissolved oxygen standards of the next size category of streams.

For purposes of determining effluent discharge limits, the following conditions shall apply:

1) The primary season dissolved oxygen standard is to be met at a water temperature of 22 ^{o}C (71.5 ^{o}F) and at the minimum stream flow for that season. At water temperatures of 10 ^{o}C (50 ^{o}F), the dissolved oxygen standard is 6.5 mg/L.

2) During March, April and May, when background stream flows are 15 CFS or higher, the D.O. standard is 6.5 mg/L in all areas except the Delta Ecoregion, where the primary season D.O. standard will remain at 5 mg/L.

3) The critical season dissolved oxygen standard is to be met at maximum allowable water temperatures and at Q7-10 flows. However, when water temperatures exceed 22 ^{o}C (71.6 ^{o}F), a 1 mg/L diurnal depression will be allowed below the applicable critical standard for no more than 8 hours during any 24-hour period.

   The dissolved oxygen standards shown in Table III must be met.

Table III

Minimum Allowable Dissolved Oxygen Concentrations for Streams, Lakes and Reservoirs in Arkansas

Waterbodies	Limit (mg/L)	
Streams	Primary	Critical
Ozark Highlands		
<10 mi^2 watershed	6	2
10 to 100 mi^2	6	5
>100 mi^2 watershed	6	6
Boston Mountains		
<10 mi^2 watershed	6	2
>10 mi^2 watershed	6	6
Arkansas River Valley		
<10 mi^2 watershed	5	2
10 to 150 mi^2	5	3
151 mi^2 to 400 mi^2	5	4
>400 mi^2 watershed	5	5
Ouachita Mountains		
<10 mi^2 watershed	6	2
>10 mi^2 watershed	6	6
Typical Gulf Coastal		
<10 mi^2 watershed	5	2
10 to 500 mi^2	5	3
>500 mi^2 watershed	5	5
Spring-influenced Gulf Coastal		
All size watersheds	6	5
Delta		
<10 mi^2 watershed	5	2
10 to 100 mi^2	5	3
>100 mi^2 watershed	5	5
Trout Waters		
All size watersheds	6	6

Lakes and Reservoirs: Specific dissolved oxygen standards for lakes and reservoirs shall be 5 mg/L. Effluent limits for oxygen-demanding discharges into impounded waters are developed by the Effluent Policy contained in the "State of Arkansas Continuing Planning Process". However, the Commission may after full satisfaction of the intergovernmental coordination and public participation provisions of the state's continuing planning process, establish alternative limits for dissolved oxygen in lakes and reservoirs where studies and other relevant information can demonstrate that predominant ecosystem conditions may be more accurately reflected by such alternate limits; provided that theses limits shall be compatible with all designated beneficial uses of named lakes and reservoirs.

Radioactivity - The Rules and Regulations for the Control of Sources of Ionizing Radiation of the Division of Radiological Health, Arkansas Department of Health, limits the maximum permissible levels of radiation that may be present in effluents to surface waters in uncontrollable areas. These limits shall apply for the purposes of these standards, except that in no case shall the levels of dissolved radium-226 and strontium-90 exceed 3 and 10 picocuries/liter, in the receiving water after mixing, nor shall the gross beta concentration exceed 1000 picocuries/liter.

Bacteria - The Arkansas Department of Health has the responsibility of approving or disapproving surface waters for public water supply and of approving or disapproving the suitability of specifically delineated outdoor bathing places for body contact recreation, and it has issued rules and regulations pertaining to such uses.

For the purposes of this regulation, all streams with watersheds less than 10 mi^2 shall not be designated for primary contact unless and until site verification indicates that such use is attainable. The determination of fecal coliform levels for the following waters shall be based on a minimum of not less than five samples taken over not more than a 30-day period.

1) Extraordinary Resource Waters and Natural and Scenic Waterways - At no time shall the fecal coliform content exceed a geometric mean of 200/100 mL in any size of watersheds.

2) Primary Contact Waters - Between April 1 and September 30, the fecal coliform shall not exceed a geometric mean of 200/100 mL nor shall more than 10 percent of the total samples during any 30-day period exceed

400/100 mL. During the remainder of the calendar year, these criteria may be exceeded, but at no time shall the fecal coliform content exceed the level necessary to support secondary contact recreation.

3) Secondary Contact Waters - The fecal coliform content shall not exceed a geometric mean of 1000/100 mL, nor equal or exceed 2000/100 mL in more than 10 percent of the samples taken in any 30-day period.

Toxic Substances - Toxic materials shall not be present in receiving waters, after mixing, in such quantities as to be toxic to human, animal, plant or aquatic life or to interfere with the normal propagation, growth and survival of the indigenous aquatic biota. Within the mixing zone there may be a zone of initial dilution which exceeds the acute toxicity. In no instance shall the entire mixing zone be acutely toxic. Compounds known to be persistent, cumulative, carcinogenic or to exhibit synergism with other waste or stream components shall be addressed on a case by case basis. Permitting of all toxic materials shall be in accordance with the toxic implementation strategy found in the Continuing Planning Process. The substances and criteria are listed in Table IV. Discharge limits based on the numeric criteria listed in Table IV may be modified in consideration of the following factors:

1) Analytical Detectability - concentration limits for specific toxic materials in discharge permits will not be required to be less than practical quantitative limits.

2) Bioavailability of specific toxics in the effluent.

3) Persistence and degradation rate of specific toxics in the mixing zone.

4) Synergistic or antagonistic interactions with other materials.

5) Technological or economic limits of treatability for specific criteria, in accordance with Section 302(b)(2)(B) of the Clean Water Act, as amended.

The permittee shall also have the option to develop specific numerical limits for toxic substances using EPA approved bioassay methodology and guidance contained in "Water Quality Standards Handbook", "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms", "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms".

Table IV

Toxic Substances and Criteria
for
Waters in Arkansas

Substance	Chronic* Toxicity	Acute** Toxicity
PCBs	0.014	2.0
Aldrin		3.0
Dieldrin	0.0019	2.5
DDT (& metabolites)	0.0010	1.1
Endrin	0.0023	0.18
Toxaphene	0.0002[1]	0.73[2]
Chlordane	0.0043	2.4
Endosulfan	0.056	0.22
Heptachlor	0.0038	0.52
Hexachlorocyclohexane	0.080	2.0
Pentachlorophenol	e[1.005(pH)-5.290][1]	e[1.005(pH)-4.830]
Chloropyrifos	0.041[1]	0.083[2]
Selenium[3]	35	260
Silver[3]	0.12	***

*24 hour average (micrograms per liter)
**never to exceed (micrograms per liter)
*** e[1.72{ln(hardness)}-6.52]
1 - Four-day average
2 - One-hour average
3 - Total recoverable
4 - Total of all isomers

Nutrients Materials stimulating algal growth shall not be present in concentrations sufficient to cause objectionable algal densities or other nuisance aquatic vegetation. As a guideline, total phosphorus shall not exceed 100 micrograms per liter in waters highly laden with natural silts or color which reduce the penetration of sunlight needed for plant photosynthesis, or in other waters where it can be demonstrated that algal production will not interfere with or adversely affect designated uses and/or fish and wildlife propagation.

The Commission may establish alternative nutrient limitations for lakes, reservoirs and streams, and appropriate water quality management plans.

Oil and Grease - Oil, grease or petrochemical substances shall not be present in receiving waters to the extent that they produce globules or other residue or any visible, colored film on the surface, or coat the banks and/or bottoms of the watercourses or adversely affect any of the associated biota. As a guideline, oil and grease shall not exceed 10 mg/L average or 15 mg/L maximum when discharging to surface waters.

Mineral Quality - Existing mineral quality shall not be altered by municipal, industrial, other waste discharges or instream activities so as to interfere with designated uses. The following limits apply to the streams indicated, and represent concentrations of chloride (Cl^-), sulfate ($SO_4^=$) and total dissolved solids (TDS) not to be exceeded in more than one (1) in ten (10) samples collected over a period of not less than 30 days or more than 360 days.

As a guideline for tributary streams not listed in Table V, an increase up to 15 mg/L chlorides and 15 mg/L sulfates or an increase of 1/3 over naturally occurring levels, whichever is greater, may be permitted. In no cases shall discharges cause concentrations in the tributary stream to exceed 250, 250 and 500 mg/L of chlorides, sulfates and total dissolved solids, respectively, or cause concentrations to exceed the applicable criteria in the streams to which they are tributary.

Modification of these standards on a site-specific stream segment must be made in accordance with the Antidegradation Policy Implementation Procedure. In no case shall discharges cause concentrations of Cl^-, $SO_4^=$ and TDS to exceed 250, 250 and 500 mg/L.

Drinking Water Regulations

In conformance with the Safe Drinking Water Act of 1974, the Environmental Protection Agency has established regulations for drinking water quality for public supplies in the United States. These include both primary and secondary drinking water quality requirements. The primary regulations represent maximum contaminant levels (not-to-exceed concentrations) for the various parameters included. The secondary regulations represent recommended standards, or guidelines. It is important to realize that both the pri-

Table V

Maximum Allowable Limits for
Chloride, Sulfate And Total Dissolved Solids

Stream	Concentration mg/L		
	Cl^-	$SO_4^=$	TDS
Arkansas River Basin			
Arkansas River (Mouth to L&D #7)	250	100	500
Arkansas River (L&D #7 to L&D #10)	250	100	500
Cadron Creek	20	20	100
Arkansas River (L&D #10 to Oklahoma line, including Dardanelle Reservoir)	250	120	500
James Fork	20	100	275
Illinois River	20	20	300
White River Basin			
White River (Mouth to Dam #3)	20	60	430
Big Creek	20	30	270
Cache River	20	30	270
Bayou DeView	20	30	270
Little Red River (including Greers Ferry Reservoir)	20	30	100
Black River	20	30	270
Strawberry River	20	30	270
Spring River	20	30	270
Eleven Point River	20	30	270
South Fork Spring River	20	30	270
Myatt Creek	20	30	270
Current River	20	30	270
White River (Dam #3 to Missouri line including Bull Shoals Reservoir)	20	20	180
Buffalo River	20	20	200
Crooked Creek	20	20	200
White River (Missouri line to head-waters, including Beaver Reservoir)	20	20	160
Kings River	20	20	150
West Fork White River	20	20	150
St. Francis River Basin			
St. Francis River (Mouth to 36 ° N. Lat.)	10	30	330
L'Anguille River	20	30	235
Tyronza River	20	30	350
Little River	20	30	365
Pemiscot Bayou	20	30	380
St. Francis River (36 ° N. Lat. to 36 ° 30' N. Lat.)	10	20	180

Table V (Cont'd)

Maximum Allowable Limits for
Chloride, Sulfate And Total Dissolved Solids

Stream	Concentration mg/L Cl^-	$SO_4^=$	TDS
Ouachita River Basin			
Bayou Bartholomew	30	30	220
Chemin-A-Haut Creek	50	20	500
Overflow Creek	20	30	170
Bayou Macon	30	40	330
Boeuf River	90	30	460
Big Cornie Creek	230	30	500
Little Cornie Creek	200	10	400
Three Creeks	250	10	500
Little Cornie Bayou	200	20	500
Bayou D'Loutre	250	90	500
Ouachita River (Louisiana line to Camden)	160	40	350
Saline River	20	40	120
Hurricane Creek	20	250	500
Lost Creek	20	250	500
Holly Creek	20	250	500
Moro Creek	30	20	260
Smackover Creek	250	30	500
Ouachita River (Camden to Carpenter Dam)	50	40	150
Little Missouri River	10	10	90
Garland Creek	250	250	500
Ouachita River (Carpenter Dam to Headwaters, including Lake Ouachita tributaries)	10	10	100
Red River Basin			
Bayou Dorcheat	100	10	250
Cypress Creek	250	70	500
Crooked Creek	250	10	500
Bodcau Creek	250	70	500
Poston Bayou	120	40	500
Kelly Bayou	90	40	500
Red River	250	200	500
Sulphur River	120	100	500
Days Creek	250	250	500
McKinney Bayou	180	60	480
Little River	20	20	200
Saline River	20	10	90
Cossatot River	10	15	70
Rolling Fork	20	20	100
Mountain Fork	20	20	110

Table V (Cont'd)

Maximum Allowable Limits for
Chloride, Sulfate And Total Dissolved Solids

Stream	Concentration mg/L Cl^-	$SO_4^=$	TDS
Mississippi River (Louisiana line to Arkansas River)	60	150	425
Mississippi River (Arkansas River to Missouri River)	60	175	450

mary and secondary drinking water regulations are for water following treatment, rather than for untreated (raw) water. The maximum contaminant levels for the National Interim Primary Drinking Water Regulations are shown in Table VI.

The National Secondary Drinking Water Regulations are shown in Table VII. As indicated, the secondary drinking water regulations are recommended (not mandatory) standards.

In addition to these standards, maximum contaminant levels have been established for trihalomethanes and for eight volatile organic chemicals. Standards for several other parameters have either recently been established or are under consideration. However, the primary and secondary drinking water regulations shown in Tables VI and VII provide a good basis for evaluating a potential water supply source.

Table VI

National Interim Primary
Drinking Water Regulations

Constituent	Maximum* Contaminant Level
Inorganic Chemicals	
Arsenic	0.05
Barium	1
Cadmium	0.010
Chromium (total)	0.05
Fluoride	1.4-2.4**
Lead	0.05
Mercury	0.002
Nitrate (as N)	10
Selenium	0.01
Silver	0.05
Organic Chemicals	
Chlorinated hydrocarbons	
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.05
Chlorophenoxys	
2,4-D	0.1
2,4,5-TP Silvex	0.01
Physical Parameters	
Turbidity	1
Radioactivity	
Gross alpha (pCi/L)	15
Radium-226 and 228 (pCi/L)	5
Tritium (pCi/L)	20,000
Strontium-90 (pCi/L)	8
Bacteriological factors	
Coliform bacteria (per 100 mL)	1

* All concentrations in mg/L unless otherwise indicated

** Temperature dependent

Table VII

National Secondary
Drinking Water Regulations

Constituent	Maximum Contaminant Level
Chloride	250 mg/L
Color	15 units
Copper	1 mg/L
Corrosivity	Noncorrosive
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 TON*
pH	6.5-8.5
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

* Threshold Odor Number

Section III

BLUE MOUNTAIN LAKE BASIN DESCRIPTION

Project Description

Location. Blue Mountain Lake is a multipurpose project located on the Petit Jean River in western Arkansas. Blue Mountain Dam is located at river mile 74.4 on the Petit Jean River. The reservoir is located in Logan and Yell Counties. The dam is about one and one-half southwest of the city of Waveland.

General Description. Blue Mountain Lake is operated primarily for flood control. Recreational opportunities are also available in and around the lake. Construction of the outlet works began in 1940 and the overall project was completed in June, 1947.

The upper levels of the lake are reserved for storage of flood water. At the top of the flood control pool, the lake will cover 11,000 surface acres and will contain 233,000 acre-feet of flood control storage. At the top of the conservation pool level, the lake stores 25,000 acre-feet of water. At the top of the conservation pool the lake covers 2,910 surface acres. The outlet works include a twenty foot diameter tunnel. The tunnel is 1,032 feet long.

Tributary streams to Blue Mountain Lake include Sinking Mountain Creek, Cedar Creek, Dry Creek, Sugar Creek, Mixon Creek, Smiths Branch, Lick Creek, Scott Creek, Prairie Creek, Reville Creek, Chigger Creek, Briar Creek, Ashley Creek and the Petit Jean River.

Facilities and Operations

Dam. Blue Mountain Dam extends a distance of 2,800 feet across the Petit Jean River valley. It rises to a height of 115 feet above the streambed. The spillway is 150 feet long. The outlet works include a twenty foot diameter tunnel which is 1,032 feet long.

Flood Control. Pertinent data concerning Blue Mountain Land and Blue Mountain Dam are included in Table VIII.

Pool Fluctuation and Streamflow. The project was designed and constructed to provide for the top of the flood control pool to be at an elevation of 419 feet above mean sea level. The top of the conservation pool is 387 feet from April to October and 384 feet from October to April.

Lake Basin Characteristics.

General. Blue Mountain Lake lies within the boundaries of Logan and Yell Counties in Arkansas. Communities in the vicinity of the lake include Blue Mountain, Booneville and Magazine.

Fish and Wildlife. A variety of fish species are present in the lake. Among these are largemouth, spotted and white bass, crappie, bream and catfish.

Hunting is popular in this general area. Species include squirrel, rabbit and deer. Bobcats, foxes and other wildlife are less frequently seen.

Public Use Areas. There are nine public use areas around the lake. These are the Ashley Creek, Hise Hill, Lick Creek, Outlet Area, Quarry Bluff, Ribelin Knoll, The Narrows, Tower Heights and Waveland Park sites. Available

Table VIII

Pertinent Data for Blue Mountain Lake and Dam

Dam	
Length of Dam, feet	2,800
Maximum height above streambed, feet	115
Spillway	
Length of spillway section, feet	150
Lake	
Top of flood control pool	
Elevation, feet above mean sea level	419
Surface Area, acres	11,000
Storage capacity of lake, acre-feet	233,000
Top of Conservation Pool	
Elevation, feet above mean sea level	
October to April	387
April to October	384
Surface area, acres	2,910
Storage capacity of lake, acre-feet	25,000
Length of shoreline, miles	
Top of flood control pool	89
Top of conservaton pool	50

facilities include boat launching ramps, picnic areas, campgrounds, swimming beaches, playground, potable water supply and sanitary facilities. A swimming beach is available at the Waveland Park site.

Section IV

WATER QUALITY DATA AND COLLECTION SUMMARY

Water Quality Monitoring Site Description

Station Number 1. Referred to in this report as the Petit Jean River site, Station Number 1 is located downstream from the dam. The latitude and longitude are 35°-06'-17" and 93°-37'-53". The site is located in Yell County.

Station Number 2. Station Number 2 is located upstream from the dam in the lake. The latitude and longitude are 35°-06'-06" and 93°-39'-02". The sampling site is referred to as the Waveland site in this report. The site is located in Yell County.

Station Number 3. Referred to in this report as the Ashley Creek site, Station Number 3 is located in Blue Mountain Lake near Ashley Creek. The latitude and longitude are 35°-06'-21" and 93°-42'-27". The site is located near the Logan and Yell county line.

Station Number 4. Station Number 4 is located in Blue Mountain Lake near Sugar Grove at the Highway 109 bridge. The latitude and longitude are 35°-04'-48" and 93°-48'-03". The site is located in Logan County and is referred to as the Highway 109 site in this report.

Station Number 5. Station Number 5 is located in Blue Mountain Lake near Sugar Grove at the Sugar Creek arm of the lake. The latitude and longitude are 35°-04'-38" and 93°-49'-08". The site is located in Logan County. It is referred to as the Sugar Grove site in this report.

Station Number 6. Station Number 6 is located in Blue Mountain Lake near the city of Magazine northwest of Potts Ridge. The latitude and longitude are 35^{o}-07'-39" and 93^{o}-48'-34". The site is located in Logan County and is referred to as the Narrows site in this report.

Water Quality Monitoring Data

Station Number 1 (Petit Jean River Site). The overall period of record at the Petit Jean River site extends from May 2, 1960 until the present. Analyses conducted include total alkalinity, biochemical oxygen demand, chloride, color, conductivity, dissolved oxygen, total hardness, calcium, dissolved calcium, dissolved magnesium, un-ionized ammonia nitrogen, ammonia nitrogen, Total Kjeldahl Nitrogen, nitrate nitrogen, pH, total phosphorous, orthophosphate, sulfate, temperature, transparency, turbidity, and metals. The metals analyses conducted included aluminum, arsenic, chromium, copper, iron, lead, manganese, mercury, nickel, potassium and zinc.

Station Number 2 (Waveland Site). The overall period of record at the Waveland site extends from February 1, 1967 until the present. Analyses conducted included total alkalinity, biochemical oxygen demand, chlorophyll a, chlorophyll b, chloride, color, conductivity, dissolved oxygen, fecal coliform, total hardness, calcium, dissolved calcium, dissolved magnesium, un-ionized ammonia nitrogen, ammonia nitrogen, Total Kjeldahl Nitrogen, nitrate nitrogen, pH, total phosphorous and orthophosphate, sulfate, temperature, transparency, turbidity, and metals. The metals analyses conducted included aluminum, arsenic, chromium, copper, iron, lead, manganese, mercury, nickel, potassium and zinc. The Waveland site also included the dissolved oxygen, temperature, conductivity and pH profile data. Only six analyses were conducted for carbon dioxide and eight for total phosphate. Graphs were not prepared for these parameters.

Station Number 3 (Ashley Creek Site). The overall period of record at the Ashley Creek site extends from July 31, 1975 until the present. Analyses conducted included total alkalinity, biochemical oxygen demand, chlorophyll a, chlorophyll b, chloride, color, conductivity, dissolved oxygen, fecal coliform, total hardness, calcium, dissolved calcium, dissolved magnesium, un-ionized ammonia nitrogen, ammonia nitrogen, Total Kjeldahl Nitrogen, nitrate nitrogen, pH, total phosphorous, orthophosphate, temperature, transparency and turbidity. Only one concentration was reported for ammonia nitrogen, un-ionized ammonia nitrogen and Total Kjeldahl Nitrogen. Two concentrations were reported for carbon dioxide and bicarbonate alkalinity. Five were reported for chloride. Graphs were not prepared for these parameters.

Station Number 4 (Highway 109 Site). The overall period of record at the Highway 109 site extends from July 31, 1975 until the present. Analyses conducted included total alkalinity, biochemical oxygen demand, chlorophyll a, chlorophyll b, chloride, color, conductivity, dissolved oxygen, fecal coliform, total hardness, calcium, dissolved calcium, dissolved magnesium, un-ionized ammonia nitrogen, ammonia nitrogen, Total Kjeldahl Nitrogen, nitrate nitrogen, pH, total phosphorous, orthophosphate, temperature, transparency, turbidity, and metals. The metals analyses conducted included aluminum, arsenic, chromium, copper, iron, lead, manganese, mercury, nickel, potassium and zinc.

Station Number 5 (Sugar Grove Site). The overall period of record at the Sugar Grove site extends from July 31, 1975 until the present. Analyses conducted included total alkalinity, biochemical oxygen demand, chlorophyll a, chlorophyll b, chloride, color, conductivity, dissolved oxygen, fecal coliform, total hardness, calcium, dissolved calcium, dissolved magnesium, un-ionized ammonia nitrogen, ammonia nitrogen, Total Kjeldahl Nitrogen, nitrate nitrogen, pH, total phosphorous, orthophosphate, temperature, transparency and turbidity. Single concentrations were reported for ammonia nitrogen, un-ionized ammonia nitrogen and Total Kjeldahl Nitrogen. Three concentrations were reported for carbon dioxide and four for chloride. Consequently, graphs were not prepared for these parameters.

Station Number 6 (The Narrows Site). The overall period of record at the Narrows site extends from July 31, 1975 until the present. Analyses conducted included total alkalinity, biochemical oxygen demand, chlorophyll a, chlorophyll b, chloride, color, conductivity, dissolved oxygen, fecal coliform, total hardness, calcium, dissolved calcium, dissolved magnesium, un-ionized ammonia nitrogen, ammonia nitrogen, Total Kjeldahl Nitrogen, nitrate nitrogen, pH, total phosphorous, orthophosphate, temperature, transparency and turbidity. Only one concentration was reported for ammonia nitrogen, un-ionized ammonia nitrogen and Total Kjeldahl Nitrogen. Two concentrations were reported for bicarbonate alkalinity and three for carbon dioxide. Graphs were not prepared for these two parameters.

Analysis of Data

Two approaches were taken in analyzing the data contained in the record for each site. These were to prepare graphs of the seasonal data and to conduct statistical analyses of both the seasonal data and all of the data for each parameter. The term seasonal data refer to the samples collected three times per year. For consistency purposes, the three seasons were defined as extending from April 15 to June 15, July 15 through September 15 and from November 15 through January 15 of the succeeding year. Additionally, graphs containing very few points were excluded from the report.

Station Number 1 (Petit Jean River Site). The figures showing the data graphically for this site are included in Appendix A. Summaries of the statistical analyses are included in Tables IX, X and XI.

Alkalinity. Alkalinity is an important water quality parameter because it is usually the principal parameter which provides buffering capacity in water. As a buffer, it resists changes in pH, either increases or decreases. Consequently, the larger the alkalinity concentration, the greater the resistance to change in pH. Thus, while large concentrations are undesirable in most circumstances, the presence of moderate concentrations of total alkalinity is ordinarily desirable.

Two parameters are frequently reported for alkalinity. These are total alkalinity and phenolphthalein alkalinity. Phenolphthalein alkalinity is present only when the pH of the water exceeds 8.3. Only total alkalinity was reported at the Petit Jean River site.

The total alkalinity concentrations were usually quite small in the river. Alkalinity concentrations in water less than 50 mg/L would be considered small.

The minimum total alkalinity concentrations were 10, 17 and 12 mg/L in the May, August and December periods. The average concentrations for the three seasonal periods were 13, 112 and 17 mg/L. The maximum concentrations were 19, 750 and 20 mg/L. The overall minimum, average and maximum concentrations were 5, 38 and 750 mg/L. The term "overall" as used in this context refers to the minimum, average and maximum concentrations being determined for all of the data included in the record. The record occasionally included parameter concentrations which were not in the three seasons as defined. Consequently, the overall minimum, average and maximum concentrations are also reported. The maximum total alkalinity concentration of 750 mg/L was suspect because it is very much larger than any other alkalinity concentration in the record.

As indicated by these data and by Figures A1, A2 and A3, the total alkalinity concentrations were variable both seasonally and as function of time. One spike of 750 mg/L was reported in the August period of 1988. This concentration is about thirty times as large as the second largest concentration. Except for the large concentration, all of the remaining alkalinity concentrations were within acceptable levels. Figures A1 and A3 indicated the total alkalinity concentrations seem to be cyclical with periods of decreasing concentrations followed by periods of increasing concentrations.

Five-Day Biochemical Oxygen Demand. Biochemical oxygen demand is a measure of the oxygen used by microorganisms in stabilizing biologically degradable organic material. The source of the organic material may be wastewater, naturally occurring materials in the watershed which are washed into the water during runoff periods, or may be naturally growing materials in the river (such as algae and other microorganisms).

The average five-day biochemical oxygen demand concentrations were 2.2, 1.7 and 1.6 mg/L in the May, August and December periods, respectively. These averages indicate some seasonal variation. The larger five-day biochemical oxygen demand concentrations occurred during the May period. This may reflect the organic material being carried into the lake with the runoff occurring during the spring rainy season. The maximum five-day biochemical oxygen demand concentrations were 3.8, 3.1 and 2.4 mg/L for the data collected for the three seasonal periods. The minimum concentrations were 1.1, 0.2 and 0.8 mg/L, respectively, in the

May, August and December periods. The data are shown graphically in Figures A4, A5 and A6.

The five-day biochemical oxygen demand concentrations generally were variable as a function of time in the May and December periods. A general trend for increasing five-day biochemical oxygen demand concentrations as a function of time in the August period occurred from 1975 until 1981. Since 1981, the concentrations have generally been decreasing with the passage of time. These data are shown in Figure A5.

When all of the data were combined, the minimum, average and maximum concentrations were 0.2, 1.8 and 3.8 mg/L. Substantial increases in these concentrations would be required for them to be troublesome. For all three seasons, the five-day biochemical oxygen demand concentrations would be considered about average for an impounded surface water.

Chloride. The minimum, average and maximum concentrations for all of the data were 0, 3.8 and 7.0 mg/L. These chloride concentrations were very small compared with the recommended drinking water limit of 250 mg/L. Regulation No. 2 does not list a specific standard for the Petit Jean River. Consequently, the river would be covered under the general clause allowing an increase up 15 mg/L or an increase of one-third over the naturally occurring levels whichever is greater. The increase cannot cause the concentrations to exceed 250 mg/L. Since the natural levels are small, the allowable increase would be up to 15 mg/L. In any case, the chloride concentrations in the Petit Jean River would be considered very small.

The average concentrations were 3.0, 3.9 and 4.2 mg/L in the May, August and December periods. These averages indicated some seasonal variation with respect to chloride. The maximum concentrations were 6.0, 5.0 and 6.0 mg/L for the three seasonal periods. The minimum concentrations were 0, 2.0 and 3.0 mg/L.

Figures A7, A8 and A9 show the chloride concentrations as a function of time for the three seasonal sampling periods. As shown by Figure A8, there has been a general trend for the chloride concentrations to decrease as a function of time since 1977 in the August period. Except for the peak in 1982, the chloride concentrations have generally been decreasing in the May period. In the December period, the chloride concentrations since 1987 have generally been increasing.

Color. Color is a physical water quality parameter that is commonly measured in surface water resources. Color may result from the presence of plankton, weeds, humus and peat materials, wastewaters and natural metallic ions (usually iron and/or manganese).

Figures A10, A11 and A12 show the color data for the three seasonal sampling periods. As shown by the three figures, the color concentrations varied considerably both as a function of the season of the year and as a function of time. The color concentration of 1,500 units in the sample collected during the August 1977 seasonal period was very large for an impounded surface water. Consequently, it greatly influenced the average seasonal value in the August period. Except for the sample collected during the August period in 1977, the color concentrations were relatively consistent in the August period. As shown in Figure A10, the color concentrations in the May period have generally been increasing since 1960. This increase, however, was not continuous. As shown by Figure A12, the color concentrations have been variable in the December period.

The average concentrations were 59, 198 and 46 units for the May, August and December periods. The maximum concentrations were 100, 1,500 and 120 units in the May, August and December periods. The minimum concentrations were 8, 20 and 5 units for the three seasonal periods. When all of the color data were combined, the minimum, average and maximum color concentrations were 5, 112 and 1,500 units.

With respect to color, the general rule of thumb is that water with a color in excess of 50 units may limit photosynthesis and may have a deleterious effect upon aquatic life. The aquatic life particularly includes phytoplankton and the benthos. In the May period in 1986, 1987 and 1988, the color concentrations have been 100 units. Similarly, on two occasions in the December period, 1981 and 1985, the color concentrations have exceeded the rule of thumb. Obviously, the color in the sample collected in the August period of 1977 was also of concern. There are many possible sources of color. Consequently, it was not possible to define the source of color in the river from the data included in the record. For example, color can be either mineral or organic in origin. Metals such as iron and manganese compounds can contribute color. Similarly, organic materials such as humic materials, plankton, rooted and floating aquatic plants, tannins, peat and other organics can cause color. Color may also be imparted to water by various industrial effluents.

Conductivity. Conductivity is a measure of the ability of a water to carry an electrical current. This ability depends on the presence of ions, their valence, the relative concentrations of monovalent and multivalent ions, the temperature of the water and on the total concentration of the ions.

Over time, a reasonable relationship can usually be established between conductivity and total dissolved solids for a particular water, if dissolved solids data are available. This relationship is not necessarily constant often because of the presence of nonconducting materials, such as very fine clays which are measured in the dissolved solids test, but which are poor conductors of electricity. However, given sufficient data a good approximate relationship can usually be established.

Figures A13, A14 and A15 show the data for the three seasonal periods. As shown by these figures, the conductivity values in the Petit Jean River were relatively small which indicated a water with relatively small concentrations of ions. Overall, the maximum concentration was 93 micromhos per centimeter. The minimum, average and maximum conductivity values were 35, 64 and 93 micromhos per centimeter for all data in the record.

The minimum, average and maximum conductivity values for the May period were 50, 57 and 73 micromhos per centimeter. The minimum, average and maximum in the August period were 58, 70 and 86 micromhos per centimeter. In the December period, the minimum, average and maximum values were 35, 61 and 91 micromhos per centimeter. Thus, the average seasonal conductivity values were 50, 58 and 35 micromhos per centimeter which indicated some seasonal variation.

As shown in Figures A13 and A14, the conductivity values have been relatively constant in the May and August periods. The December data have been more variable. Generally, the conductivity values were low during the mid-1980s and have increased to near average concentrations in the last three years in the December period.

Although there is no water quality standard for conductivity as such, the parameter is related to total dissolved solids. The total dissolved solids standard for the Petit Jean River is a maximum of 500 mg/L.

Dissolved Oxygen. Dissolved oxygen is a measure of the oxygen concentration in the water. Since aerobic organisms, both micro and macro, require the presence of free molecular oxygen to thrive, dissolved oxygen is a very important water quality parameter in streams and lakes. The presence of low dissolved oxygen concentrations can result in fish kills and other deleterious effects on aquatic life. Dissolved oxygen concentrations exceeding six milligrams per liter are considered adequate for sport fish such as bass. Fish can tolerate smaller concentrations depending on the time of year. The primary standard for dissolved oxygen in the Petit Jean River is 5 mg/L. Since the drainage area about the dam is 488 square miles, the applicable critical standard is also 5 mg/L.

The seasonal data are shown in Figures A16, A17 and A18. The dissolved oxygen concentrations were less than the stream standard of 5 mg/L on only one occasion. Thus, the dissolved oxygen concentrations were good. The average concentrations were 10.4, 6.6 and 11.8 mg/L in the May, August and December periods, respectively. The averages indicated a substantial seasonal variation in the dissolved oxygen concentrations. However, this was expected because the saturation concentration for dissolved oxygen decreases with increasing temperature and because the rate of microbial activity increases with increasing temperature.

The general trend has been for the dissolved oxygen concentrations to remain relatively constant as a function of time for all three seasons. There were some variations from year to year, but this variation was not exceptionally large. Similarly, there were some periods of decreasing and increasing dissolved oxygen concentrations as a function of time, but the overall trend was for the dissolved oxygen concentrations to remain relatively constant.

The minimum concentrations were 6.4, 4.8 and 9.7 mg/L in the May, August and December periods. The maximum concentrations were 45, 8.2 and 15.0 mg/L for the three seasonal periods. The dissolved oxygen concentration of 45 mg/L was very large. The dissolved oxygen concentrations, expressed as percent of saturation, are shown in Figures A19, A20 and A21.

<u>Hardness</u>. The total hardness data in the May, August and December seasonal samples are shown in Figures A22, A23 and A24 at the Petit Jean River site. As shown by these figures, the total hardness concentrations in the samples collected were relatively small. The maximum concentration was 38 mg/L which indicated the water was soft. For reference purposes, a total hardness concentration of 100 mg/L, or less, would ordinarily be considered acceptable for a domestic water supply.

The minimum, average and maximum total hardness concentrations for all of the data were 8, 20 and 38 mg/L. In the May period, the minimum, average and maximum concentrations were 8, 17 and 31 mg/L. The minimum, average and maximum concentrations in the August period were 15, 22 and 38 mg/L. In the December period, the minimum, average and maximum concentrations were 12, 17 and 20 mg/L. The general trend has been for decreasing total hardness concentrations as a function of time in the August period. A general tendency for decreasing total hardness concentrations since 1981 has been apparent in the May period. In the December period, the total hardness concentrations have remained relatively constant.

The calcium data are shown in Figures A25, A26 and A27. As shown by Figure A25, the general trend for calcium during the May period was, following a peak concentration in 1978, for the calcium concentrations to stay about the same. In the August period, the overall trend since 1979 has been for decreasing calcium concentrations. The tendency in the December period was for the calcium concentrations to stay about the same.

The dissolved calcium data are shown in Figures A28, A29 and A30. The minimum, average and maximum concentrations for dissolved calcium were 2.2, 3.6 and 8.2 in the May period. In the August period, the minimum, average and maximum concentrations were 3.2, 5.0 and 8.2 mg/L. In the December period, the minimum, average and maximum concentrations were 2.6, 3.4 and 4.1 mg/L. These data are expressed as calcium. Converted to expression as calcium carbonate, the data indicated that the total hardness was primarily calcium hardness. Except for the peak concentration in 1978, the general trend was for very little variation in the dissolved calcium concentrations as a function of time for the May period. The dissolved calcium concentrations decreased during the August period from 1979 until 1982 and increased from 1982 until 1987. In the December period, the dissolved calcium concentrations remained about the same.

The dissolved magnesium data are shown in Figures A31, A32 and A33. As indicated by these figures, there was very little magnesium in the water. The maximum dissolved magnesium concentration was 3.4 mg/L (expressed as Mg). The average dissolved magnesium concentrations were 2.1, 2.4 and 2.3 mg/L in the May, August and December periods, respectively. For municipal water supply purposes with respect to hardness, the river would be considered to be an excellent water supply source. The dissolved magnesium concentrations were variable in the May period with no apparent overall trend. In the August period, the pattern has been for generally increasing dissolved magnesium concentrations, but this pattern has been discontinuous.

The noncarbonate hardness data are shown in Figures A34, A35 and A36. The term "noncarbonate" hardness refers to calcium and/or magnesium which is associated with anions other than alkalinity. The anions are usually sulfate and/or chloride. The maximum noncarbonate hardness was 14 mg/L which was relatively small and not particularly significant.

Metals. Figures A37, A38 and A39 show the seasonal data for aluminum. The maximum aluminum concentration for all of the data was 5,800 micrograms per liter (5.8 mg/L). The maximum concentrations in the May, August and December periods were 570, 3,200 and 350 micrograms per liter. There is no maximum contaminant level for aluminum in drinking water. Similarly, there is no stream standard for aluminum. In general, the toxicity limit is considered to be about 1 mg/L for terrestrial plants in acid and alkaline soils. Consequently, it was difficult to assess the significance of the occasionally large concentrations of aluminum. The maximum concentration of 5,800 micrograms per liter was unusual for lake water in Arkansas. As shown in Figure A37, the overall trend has been for increasing aluminum concentrations in the May period as a function of time. This pattern was consistent until the 1982 sample was collected. In the August period, the aluminum concentrations were relatively small and consistent since the peak concentration of 3,200 micrograms per liter in 1977. The sample collected in 1976 during the August period contained 1,100 micrograms per liter. The aluminum concentrations also were increasing for the December period. It is important to note that the most recent aluminum data was collected in 1982.

The maximum arsenic concentration was 8 micrograms per liter. For reference purposes, the maximum contaminant level for arsenic in drinking water is 50 micrograms per liter. Consequently, the arsenic concentrations in the river at this site would be considered to be small. The arsenic data are shown in Figures A40, A41 and A42. Except for the one arsenic concentration in the sample collected during the August period in 1977, all of the arsenic concentrations were reported as 3 micrograms per liter or less. In the May period, the arsenic concentrations were consistently reported as 1 micrograms per liter.

The maximum chromium concentration for all data was 30 micrograms per liter. For reference purposes, the maximum contaminant level for chromium in drinking water is 50 micrograms per liter. Chromium concentrations in excess of 10 to 15 micrograms per liter are considered to be detrimental to aquatic life. Except in the December 1981 period sample, all of the chromium concentrations were reported as 20 micrograms per liter or less. There was a general trend for increasing chromium concentrations as a function of time in the May period. In the December period, the data were variable. The chromium data in the May and August periods are shown in Figures A43 and A44.

The copper data are shown graphically in Figures A45, A46 and A47 in the May, August and December periods. In larger concentrations, copper imparts an undesirable taste to water. Consequently, the recommended limit is 1 mg/L for drinking water. The minimum, average and maximum copper concentrations were 3, 5.8 and 10 micrograms per liter for the May period. In the August period, the minimum, average and maximum concentrations were 2, 6.6 and 20 micrograms per liter. The minimum, average and maximum in the December period were 0, 3.3 and 5 micrograms per liter. For all of the data, the minimum, average and maximum copper concentrations were 0, 5.4 and 20 micrograms per liter. Thus, the copper concentrations are very small in the river at this site. All of the copper concentrations were within acceptable levels for the protection of aquatic life. A general trend for increasing copper concentrations as a function of time existed in the December period from 1980 until 1982. However, they had been decreasing prior to 1980. Following a peak concentration of 20 micrograms per liter in 1975 for the August period, the copper concentrations have been small and consistent. In the December period, the copper concentrations have been smaller. Overall, the copper concentrations can be considered to be small, and insignificant, in the river.

For water which is to be used as a public water supply, iron in significant concentrations is undesirable because of the aesthetic quality problems and because of staining of clothing and plumbing fixtures. Consequently, the recommended limit for drinking water is 0.3 mg/L.

The minimum, average and maximum iron concentrations for all of the data were 400, 2,260 and 16,000 micrograms per liter. The average concentrations were 960, 3,460 and 16,000 micrograms per liter in the May, August and December periods, respectively. These averages indicated considerable seasonal variation. The maximum concentrations were 1,500, 16,000 and 1,400 micrograms per liter for the three seasonal periods. The minimum concentrations were 580, 830 and 400 micrograms per liter. The trend was for increasing iron concentrations in the May period until 1981. From 1981 until 1983, the trend was for decreasing iron concentrations as a function of time. The samples collected in 1983 were the most recent at this site. Except for the sample collected during the December period in 1981, the iron concentrations were relatively constant in the December period. Following relatively large iron concentrations in 1975 and 1977 in the August period, the iron data had been relatively constant until 1983. The iron data are shown in Figures A48, A49 and A50. The iron concentrations frequently exceeded the recommended standard for iron in drinking water. The 16,000 micrograms per liter concentration was very large.

Lead is an element which is becoming increasingly regulated in the United States. Lead accumulates in the human body with the passage of time. Consequently, there is a cumulative exposure. The maximum lead concentration found in the record was 57 micrograms per liter. Relative to lead concentrations usually found in surface water supplies in Arkansas, the 57 micrograms per liter was large. The maximum concentrations for the seasonal data were 12, 4 and 57 micrograms per liter in the May, August and December periods. The seasonal lead data are shown graphically in Figures A51, A52 and A53. As shown by these figures, there was some variation in the lead concentrations as a function of time, particularly in the May period. The lead concentrations were about constant in the August period until 1982. Except for the peak concentration in 1980, the lead concentrations were very small in the December period.

Manganese is also a parameter of concern for water to be used for municipal water supply purposes. Like iron, manganese causes an impaired taste to the water as well as staining laundry and plumbing fixtures. The recommended maximum contaminant level for manganese in drinking water is 0.05 mg/L. Figures A54, A55 and A56 show the seasonal data for manganese. The minimum, average and maximum concentrations for all of the data were 60, 410 and 1,700 micrograms per liter. In the May period, the minimum, average and maximum concentrations were 60, 170 and 330 micrograms per liter. In the August period, the minimum, average and maximum concentrations were 460, 1,060 and 1,700 micrograms per liter.

The minimum, average and maximum concentrations were 100, 150 and 200 micrograms per liter in the December period. Thus, the average seasonal concentrations were 170, 1,060 and 150 micrograms per liter. These averages indicated a substantial variation in manganese concentration with the season of the year. Except for the one concentration in 1981, the manganese concentrations were decreasing from 1979 until 1983. The trend in the December period was for relatively small, and consistent, manganese concentrations. The manganese concentrations in the August period sample were variable.

The nickel data are shown in Figures A57, A58 and A59 for the three seasonal periods. Overall, the maximum nickel concentration was 10 micrograms per liter. The maximum nickel concentrations were 7, 3, and 6 micrograms per liter for the three seasonal periods. The nickel concentrations all were well within acceptable levels for the protection of aquatic life. As shown in Figure A57, the nickel concentrations generally increased from 1978 until 1982 in the May period. Conversely, as shown in Figure A59, the nickel concentrations decreased from 1979 until 1981.

The maximum potassium concentration was 3.1 mg/L. The average seasonal concentrations were 1.4, 2.1 and 1.6 mg/L in the May, August and December periods, respectively. The maximum seasonal concentrations were 1.8, 3.1 and 1.8 mg/L. Potassium is usually not a particularly significant water quality parameter. Potassium at concentrations this small would not be considered a significant parameter by almost any ground or surface water quality scale. The data are shown graphically in Figures A60, A61 and A62. Ordinarily, the potassium concentrations were very small and relatively constant. The potassium concentrations did decrease from 1978 until 1980 in the May period. However, the concentrations increased from 1980 until 1982 for this period. The potassium data were relatively constant with a tendency for slightly decreasing concentrations as a function of time for the December period. In the August period, the potassium concentrations generally increased from 1979 until 1982.

The recommended maximum contaminant level for zinc in public water supplies is 5 mg/L. The recommended limit is included because zinc imparts an undesirable taste to water at large concentrations and causes a milky appearance at large concentrations. The maximum zinc concentration for all of the data was 50 micrograms per liter. For the seasonal data, the maximum concentrations were 20, 40 and 40 micrograms per liter. These concentrations were well within acceptable levels. The data are shown graphically in Figures A63, A64 and A65. The zinc concentrations were variable in the May and August periods. They showed a pattern for increasing zinc as a function of time in the December period. All of the zinc concentrations were within acceptable levels for the protection of aquatic life.

<u>Nitrogen</u>. Figures A66, A67 and A68 show the data for un-ionized ammonia nitrogen data at the Petit Jean River site. As shown by Figure A67, the un-ionized ammonia concentrations decreased from 1981 until 1983. The un-ionized

ammonia concentration in the sample collected during the August period in 1981 was an unusually large peak concentration of 0.002 milligram per liter. The concentrations decreased from 1980 until 1983 in the May period. A peak concentration occurred in the sample collected in 1984. This peak concentration was 0.0007 which was relatively large for un-ionized ammonia in lakes in Arkansas. In the December period, the un-ionized ammonia concentrations were relatively constant with a tendency for slightly increasing concentrations from 1980 until 1983. The average seasonal concentrations were 0.0002, 0.0006 and 0.0001 mg/L, respectively, in the May, August and December periods. The maximum seasonal concentrations were 0.0007, 0.0020 and 0.0002 mg/L. All of un-ionized ammonia nitrogen concentrations were less than the EPA criterion for the protection of aquatic life.

As shown in Figure A69, the ammonia nitrogen concentrations generally increased in the samples collected during the May period from 1978 until 1984. In the August period, the ammonia nitrogen concentrations were variable. The concentrations were small and relatively consistent in the December period. The average concentrations were 0.12, 0.13 and 0.07 mg/L, respectively, in the May, August and December periods. The maximum concentrations were 0.28, 0.33 and 0.12 mg/L for the three seasonal periods. The ammonia nitrogen data are shown in Figures A69, A70 and A71.

The organic nitrogen data are shown in Figures A72, A73 and A74 for the three seasonal periods. As shown in Figure

A72, the organic nitrogen concentrations generally increased from 1978 until 1982. The sample collected in 1982 was the most recent at this site. Conversely, the organic nitrogen concentrations decreased from 1980 until 1982 in the August period. The average organic nitrogen concentrations were 0.64, 0.65 and 0.52 mg/L in the May, August and December periods, respectively. The minimum concentrations were 0.24, 0.36 and 0.30 mg/L for the three seasonal periods. The maximum concentrations were 1.30, 1.00 and 0.67 mg/L.

The nitrate nitrogen concentrations have been variable for all three seasonal periods as shown in Figures A75, A76 and A77. They were generally larger during the early and mid-1980's than in prior and more recent samples in the May period. In the August period, a large peak concentration of 0.49 mg/L occurred in 1977 followed by small concentrations the subsequent two years. Since 1981, the data have been relatively consistent. The nitrate concentrations were generally decreasing from 1981 until 1987 in the December period. The maximum nitrate nitrogen concentration for all of the data was 0.49 mg/L. For the seasonal data, the minimum, average and maximum concentrations were 0.02, 0.11 and 0.23 mg/L in the May period. In the August period, the minimum, average and maximum concentrations were 0.02, 0.14 and 0.49 mg/L. In the December period, the minimum, average and maximum concentrations were 0, 0.12 and 0.23 mg/L. Thus, the average seasonal concentrations were 0.11, 0.14 and 0.12 mg/L which indicated some variation with respect to the season of the year.

The Total Kjeldahl Nitrogen data are shown graphically in Figures A78, A79 and A80. As shown by Figure A78, the Total Kjeldahl Nitrogen concentrations generally increased from 1978 until 1982. Following 1982, the two subsequent concentrations were considerably smaller. The data were still variable, but more consistent, in the August period than in the May period. The average seasonal concentrations were 0.63, 0.74 and 0.81 mg/L in the May, August and December periods, respectively. The data ranged form 0.20 to 1.40 mg/L in the May period. The minimum and maximum concentrations were 0.40 and 1.20 mg/L in the August period. The range in the December period was from 0.37 to 1.50 mg/L.

The total nitrogen data are shown in Figures A81, A82 and A83 for the three seasonal periods. As shown by Figure A81, the total nitrogen concentrations generally increased from 1978 until 1981 in the May period. The data were variable in the August period, but were nearly constant in the December period. The average seasonal concentrations were 0.67, 0.92 and 0.67 in the May, August and December periods, respectively. The maximum concentrations were 0.94, 1.70 and 0.73 mg/L for the three seasonal periods.

pH. The pH parameter is a measure of the hydrogen ion concentration in a water. Consequently, it is related to the acidity or alkalinity of a water. In general, organisms thrive when the pH is about neutral (7). However, a pH within 5 to 9 is usually considered to be acceptable for aquatic growth. Regulation No. 2 establishes limits for pH between 6 and 9.

Figures A84, A85 and A86 show the pH values for the three seasonal periods. As shown by these figures, the pH values were well within the limits established by the Arkansas Department of Pollution and Control in Regulation No. 2. Although there was some variation from year to year for each of the seasonal periods, the overall trends were for the pH values to stay relatively constant over the long term in the May, August and December periods. The minimum, average and maximum pH values were 6.0, 6.9 and 8.6 units for all of the data. In the May period, the minimum, average and maximum pH values were 6.2, 6.6 and 7.3 units. The minimum, average and maximum pH values in the August period were 6.2, 7.0 and 8.6 units. The minimum, average and maximum pH values were 6.3, 7.0 and 7.6 units in the December period. The average seasonal pH values were 6.6, 7.0 and 7.0 units which indicated some variation in the average values with respect to the season of the year.

Phosphorous. Figures A87, A88 and A89 show the total phosphorous data for the three seasonal periods. The overall minimum, average and maximum concentrations were 0.02, 0.08 and 0.40 mg/L in the May, August and December seasonal periods. The average concentrations were 0.07, 0.09 and 0.04 mg/L for the three seasonal periods. The August period average was influenced considerably by a peak concentration of 0.40 mg/L in 1977. This peak concentration was four times as large as any other concentration reported during the August period and was remarkably large. The total phosphorous concentrations in unpolluted lakes are usually within the range of from 0.01 to 0.05 mg/L. Since the 0.4 mg/L concentration greatly exceeded this range, it is of concern. However, all subsequent concentrations were less than 0.1 mg/L during the August period. There was a trend for decreasing total phosphorous concentrations from 1980 until 1984. However, the total phosphorous concentrations increased from 1984 until 1987. As shown by Figure A87, a peak concentration occurred in 1988 in the May period. This concentration was 0.21 mg/L and was more than twice as large as any other concentration in the May period. The total phosphorous data in the December period were relatively constant, usually with concentrations less than 0.06 mg/L.

The maximum total phosphorous concentrations were 0.21, 0.40 and 0.06 mg/L in the May, August and December periods, respectively. The minimum concentrations were all 0.02, 0.02 and 0.03 mg/L for the three seasonal periods. The total phosphorous concentrations were larger than usual for large unpolluted lakes at this site.

The total phosphate data were limited. Only eight concentrations were reported in the record. Figures A90 and A91 show these data. The maximum concentrations were 0.28, 0.15 and 0.03 mg/L, respectively, in the May, August and December periods.

<u>Sulfate</u>. Figures A92, A93 and A94 show the sulfate data which were available at the Petit Jean River sampling site. All of the sulfate concentrations were relatively small with the maximum sulfate concentration being 15 mg/L.

Regulation No. 2 does not contain a specific stream standard for sulfate in the Petit Jean River. Consequently, the allowable sulfate concentrations in the river fall under the general requirement that an increase up to 15 mg/L, or an increase of one-third over naturally occurring levels, whichever is greater, may be permitted. In no case, however, may discharges cause concentrations in the tributary streams to exceed 250 mg/L. The recommended maximum contaminant level for sulfate in drinking water is 250 mg/L. Consequently, all of the sulfate concentrations were less than the applicable standard for the Petit Jean River.

The minimum, average and maximum sulfate concentrations for all of the data were 1.0, 8.6 and 15.0 mg/L. In the May period, the minimum, average and maximum concentrations were 6.0, 8.6 and 12.0 mg/L. The minimum, average and maximum concentrations were 1.0, 6.9 and 9.0 mg/L in the August period. The minimum, average and maximum concentrations were 5.0, 7.8 and 9.0 mg/L in the December period. The average seasonal concentrations were 8.6, 6.9 and 7.8 mg/L which indicated some variation in the average seasonal concentrations.

The sulfate concentrations decreased from 1980 until 1982 in the December period. The overall trends in the May and August periods were for relatively constant, with some exceptions, sulfate concentrations for both periods. Clearly, all of the sulfate concentrations were within acceptable levels.

Temperature. The temperature of the water is greatly influenced by the day of the year the temperatures were measured. Consequently, since the definitions of the seasons were fairly broad, the variations in temperature shown in Figures A95, A96, and A97 may easily be misinterpreted. These figures show the seasonal data.

The minimum, average and maximum temperatures were 1.0, 16.4 and 29.0 degrees Celsius for all of the data. The average seasonal temperature values were 19.8, 26.1 and 8.1 degrees Celsius for the three seasonal periods. The minimum temperatures were 13.5, 21.0 and 1.0 degrees Celsius. The maximum temperatures were 24.0, 29.0 and 15.0 degrees Celsius. The applicable specific standard for temperature in lakes and reservoirs in the Arkansas River Valley Ecoregion is 32 degrees Celsius.

Turbidity. Figures A98, A99 and A100 show the turbidity data at the Petit Jean River site. The minimum, average and maximum turbidity values were 5.3, 25 and 99 FTU for all of the data. The specific stream standard for turbidity in the Arkansas River Valley Ecoregion is 21 NTU. As shown in Figure A98, the turbidity values exceeded the stream standard on numerous occasions. Although the data were variable, an overall pattern of increasing turbidity concentrations as a function of time was apparent in the May period. The data in the August period were much more constant. Although variable, the turbidity values in the December period were usually smaller than in the May period.

The maximum turbidity values for the seasonal data were 58, 31 and 42 FTU in the May, August and December periods. The minimum turbidity values were 7.0, 11 and 5.3 FTU for the three seasonal periods. The average turbidity values were 28, 19 and 16 FTU. As indicated, the average turbidity value in the May period exceeded the applicable standard for the Petit Jean River.

Station Number 2 (Waveland Site). The figures showing the data graphically for this site are included in Appendix B. Summaries of the statistical analyses are included in Table XII, XIII and XIV. The dissolved oxygen profiles are shown in Figures BD1 through BD103. Figures BT1 through BT103 show the temperature profiles from April, 1981 until August, 1989. Figures BC1 through BC103 show the conductivity profiles for the same period. The pH profiles are shown in Figures BP1 through BP103.

For the dissolved oxygen, temperature and pH figures, constant horizontal scales were used in preparing the graphs. In this manner, not only the shape of the curves can be examined, but also the relative placement of the curve on the figures was easily discernable. On occasion, the horizontal scale for the conductivity profiles was changed to accommodate larger conductivity concentrations.

As shown by Figures BD1 through BD103, Blue Mountain Lake stratifies during the summer months. However, Blue Mountain Lake does not stratify as strongly as most other lakes included in this study. The dissolved oxygen chemocline was usually about 10 to 15 foot deep level during part of the summer Figures BD21 and BD33 shown the dissolved oxygen profiles for July of 1982 and 1983, respectively. On occasion, however, the chemocline was much deeper. For example, as shown in Figure BD99 for the June, 1989 dissolved oxygen profile, the chemocline was about 25 feet deep. The lake is remixed in late fall-early winter as it destratifies.

The temperature profiles shown in Figures BT1 through BT103 also indicated the stratification, but the thermocline is often less pronounced than the dissolved oxygen chemocline. For example, Figures BT21 and BT33 show the temperature profiles for July of 1982 and 1983. As shown in Figure BT21, there was no clearly defined thermocline paralleling the chemocline shown in Figure BD21 for dissolved oxygen. Figure BT33 does show a clearly defined thermocline paralleling the chemocline for dissolved oxygen shown in Figure BD33 for dissolved oxygen.

The conductivity values were also depth related as shown by Figures BC21 and BC33 as examples. As shown by Figure BC21, the conductivity values at depth were larger than at the surface. Activity in the water below the dissolved oxygen chemocline contributes to the increased conductivity values in the lower levels of the lake. Figure BC33 shows the conductivity profile for July, 1983. For this profile, the conductivity values changed markedly at the depth of the dissolved oxygen chemocline and temperature thermocline shown in Figures BD33 and BT33.

The pH values were also clearly depth related. As an example, the profile shown in Figure BP44 shows significant decreases in pH at depths about those for the dissolved oxygen chemocline.

Except for the dissolved oxygen, temperature, conductivity and pH data collected for the profiles, most of the remaining data represent samples collected at 0.2 and 0.8 depths.

Alkalinity. The total alkalinity concentrations in the samples collected upstream from the dam were relatively small. The minimum and maximum alkalinity concentrations were 5 and 28 mg/L. The overall average concentration was 15.8 mg/L. The average seasonal total alkalinity concentrations were 12.9, 19.9 and 15.7 mg/L which indicated some seasonal variation. The minimum and maximum concentrations were 10 and 16 mg/L in the May season. The total alkalinity concentrations ranged from 10 and 28 mg/L in the August season. The minimum and maximum concentrations in the December season were 8 and 20 mg/L.

In general, the alkalinity concentrations were slightly larger in the August period than the May and December periods. However, the alkalinity concentrations were all within acceptable levels at all times.

Five-Day Biochemical Oxygen Demand. The minimum, average and maximum five-day biochemical oxygen demand concentrations were 0, 1.5 and 2.9 mg/L for all data. The minimum, average and maximum five-day biochemical oxygen demand concentrations were 0.6, 1.6 and 2.6 mg/L for the data collected in the May period. In the August period, the minimum, average and maximum concentrations were 0, 1.5 and 2.9 mg/L. The minimum, average and maximum concentrations for the December period were 0.6, 1.4 and 2.2 mg/L. The magnitudes of the ranges were 2.0, 2.9 and 1.6 mg/L, respectively, in the May, August and December seasonal periods. The data were more variable in the May and August periods than in the December period.

All of the five-day biochemical oxygen demand concentrations were 2.9 mg/L, or less, at the Waveland site. The five-day biochemical oxygen demand concentrations were at levels which would be expected in a surface water resource. The average seasonal concentrations were 1.6, 1.5 and 1.4 mg/L, respectively, in the May, August and December periods. These averages indicated little seasonal variation.

Chloride. The minimum, average and maximum concentrations for all of the data were 1.0, 4.1 and 9.0 mg/L. These chloride concentrations were very small compared with the recommended drinking water limit of 250 mg/L and were less than the applicable standard for the Petit Jean River. Regulation Number 2, published by the Arkansas Department of Pollution Control and Ecology, does not include a specific stream standard for the Petit Jean River. Consequently, the chloride content can be increased up to 15 mg/L or an increase of 1/3 over naturally occurring concentrations, whichever is greater. Since the chloride concentrations were so small in Blue Mountain Lake, the 15 mg/L increase is the controlling one. The chloride concentration cannot exceed 250 mg/L.

The average concentrations were 3.2, 3.5 and 4.0 mg/L in the May, August and December periods, respectively. The maximum concentrations were all 5.0 mg/L. The minimum concentrations were 2.0, 2.0 and 3.0 mg/L for the three seasonal periods. The magnitudes of the ranges were 3.0, 3.0 and 2.0 mg/L for the three seasonal periods. The data were relatively uniform for all three seasonal periods.

Chlorophyll a. The minimum, average and maximum chlorophyll a concentrations for all of the data were 0.3, 8.2 and 30.0 micrograms per liter. All of the chlorophyll a samples were collected at the three foot depth. In the May season, the minimum, average and maximum chlorophyll a concentrations were 0.5, 7.0 and 17.0 micrograms per liter. The minimum, average and maximum concentrations in the August period were 1.9, 10.5 and 28.0 micrograms per liter. The minimum, average and maximum concentrations in the December period were 0.3, 3.6 and 6.9 micrograms per liter. The average seasonal concentrations were 7.0, 10.5 and 3.6 micrograms per liter indicating substantial seasonal variation. The magnitudes of the ranges were 16.5, 26.1 and 6.6 micrograms per liter, respectively, in the May, August and December seasonal periods. The data were variable for all three seasonal periods, but were more variable in the May and August periods than in the December period. Chlorophyll a is a algal biomass indicator. Consequently, the larger the chlorophyll a concentration, the larger is the algal population. There are no stream or lake standards for chlorophyll a. However, a long-term trend for increasing chlorophyll a concentrations would indicate the lake is aging. Obviously, a certain amount of chlorophyll a is beneficial for the food chain. The concern develops when the chlorophyll a concentrations increase too rapidly.

Chlorophyll b. The minimum, average and maximum chlorophyll b concentrations in the May period were 0.1, 0.4 and 0.9 micrograms per liter. In the August period, the minimum, average and maximum concentrations were 0.1, 0.7 and 4.0 micrograms per liter. The minimum, average and maximum in the December period were 0.1, 0.3 and 0.8 micrograms per liter. The minimum, average and maximum chlorophyll b concentrations for all data were 0.1, 0.6 and 4.0 micrograms per liter. The magnitudes of the ranges were 0.8, 3.9 and 0.7 micrograms per liter for the three seasonal periods. The data were much more variable in the August period than in the May and December periods. The samples which were analyzed for chlorophyll b were all collected at the three foot depth.

Color. The minimum, average and maximum in the May period were 30, 67 and 120 color units. In the August period, the minimum, average and maximum concentrations were 2, 120 and 1,600 units. The minimum, average and maximum color concentrations in the December period were 5, 44 and 120 units. Thus, the average seasonal concentrations were 67, 120 and 44 units which indicated significant seasonal variations in color concentrations. For all of the data, the minimum, average and maximum concentrations were 2, 94 and 1,600 units.

The color concentrations were larger than in other lakes in western Arkansas. For example, in the May period, color exceeded the general rule of thumb of 50 units in 16 of the 28 samples collected at the Waveland site. The color concentrations also equalled or exceed 100 units on five occasions. Two of the five occasions were in samples collected at 0.2 depth. In the August period, the largest color concentration was 1,600 units which was extremely large. This occurred in the sample collected three foot deep in August of 1977. However, all of the other color concentrations were much smaller. On five occasions, the color concentration exceeded the rule of thumb value of 50 units. Except for the extremely large peak concentration of 1,600 units, all of the other instances in which the color exceeded 50 units were in samples collected at 0.8 depth. Significantly large color values also occurred during the December period. Seven of the eighteen concentrations reported in the December period exceeded 50 units. The largest concentration was 120 units in the December period. The data were variable for all three periods. The magnitudes of the ranges were 90, 1,598 and 115 units, respectively, in the May, August and December periods.

Conductivity. The minimum, average and maximum conductivity values were 34, 62 and 100 micromhos per centimeter for all data in the record. The minimum, average and maximum in the May period were 37, 56 and 73 micromhos per centimeter. The minimum, average and maximum in the August period were 52, 71 and 94 micromhos per centimeter. In the December period, the minimum, average and maximum conductivity values were 35, 57 and 90 micromhos per centimeter.

The average conductivity values were 56, 71 and 57 micromhos per centimeter in the May, August and December periods. The increased conductivity values in the lower depths during the stratification period account for nearly all of the differences in conductivity values among the three seasons. The magnitudes of the ranges were 36, 42 and 55 micromhos per centimeter for the three seasonal periods. The data were more variable in the December period than in the May and August periods.

Dissolved Oxygen. The minimum, average and maximum dissolved oxygen concentrations for all data were 0.0, 7.5 and 14.2 mg/L. The minimum, average and maximum dissolved oxygen concentrations in the May period were 0.4, 6.6 and 10.0 mg/L. In the August period, the minimum, average and maximum concentrations were 0.0, 4.2 and 7.6 mg/L. The minimum, average and maximum concentrations in the December period were 5.7, 10.7 and 14.2 mg/L. The magnitudes of the ranges were 14.2, 9.6 and 7.6 mg/L, respectively, in the May, August and December periods.

Fecal Coliform. The average fecal coliform counts were 7.5, 4.9 and 28 colonies per 100 mL in the May, August and December periods. The maximum counts were 30, 33 and 140 colonies per 100 mL. The minimum counts were 0, 0 and 1 colonies per 100 mL for the three seasonal periods.

Blue Mountain Lake and the Petit Jean River are designated as primary contact waters. Consequently, the applicable standard based on Regulation No. 2 is a geometric mean of 200 colonies per 100 mL for the period between April 1 and September 30. Additionally, the fecal coliform count shall not exceed 400 colonies per 100 mL in more than 10 percent of the samples in any one month.

The fecal coliform counts were well within acceptable levels at this site. In fact, the counts were small for surface water. The data were relatively uniform in all three seasonal periods. The magnitudes of the ranges were 30, 33 and 139 colonies per 100 mL in the May, August and December seasonal periods. These were unusually small ranges for fecal coliform analyses. The samples to be analyzed for fecal coliform were all collected at the surface.

Hardness. The total hardness concentrations in the samples collected were quite small. Consequently, the water would be considered soft with respect to its use as a water supply source. The minimum, average and maximum total hardness concentrations for all of the data were 12, 19 and 40 mg/L (expressed as calcium carbonate). The average total hardness concentrations were 16, 20 and 16 mg/L in the May, August and December periods, respectively, which indicated a slight seasonal variation. The maximum total hardness concentrations were 23, 40 and 19 mg/L for the three seasonal periods. The minimum concentrations were 12 mg/L for all three seasons. The magnitudes of the ranges were 11, 28 and

7 mg/L. The data were much more variable in the August period than in the May and December periods.

The maximum calcium concentration was 20 mg/L expressed as calcium carbonate. For comparison purposes, water with a calcium concentration of 50 mg/L or less would be considered soft for many applications. The average seasonal concentrations were 8.8, 10.4 and 8.0 mg/L, respectively, in the May, August and December seasons. The calcium concentrations ranged from 6.0 to 13.0 mg/L in the May period. In the August period, the range was from 6.0 to 14.0 mg/L. The minimum and maximum concentrations in the December period were 6.0 and 9.0 mg/L.

The dissolved calcium concentrations averaged 3.2, 4.0 and 3.2 mg/L in the May, August and December periods, respectively. The magnitudes of the ranges were 2.7, 3.4 and 1.5 mg/L for the three seasonal periods. The data were less variable in the December period than in the May and August periods.

The dissolved magnesium concentrations averaged 1.9, 2.5 and 2.3 mg/L. The maximum concentrations were 2.5, 3.0 and 2.7 mg/L. The magnitudes of the ranges were 1.2, 1.1 and 1.0 mg/L, respectively, in the May, August and December seasonal periods. There was relatively little variation in the dissolved magnesium data.

Overall, the noncarbonate hardness averaged 3.8 mg/L with the range being from 0 to 12 mg/L. Noncarbonate hardness refers to calcium and magnesium which is present in excess of the alkalinity and, thus, is associated with chloride and/or sulfate in an ionic balance. It is not desirable to have noncarbonate hardness concentrations which are too large. However, the noncarbonate hardness concentrations were all well within acceptable levels at this site. In the May period, the noncarbonate hardness ranged from 0 to 7 mg/L with an average concentration of 3.4 mg/L. The minimum, average and maximum concentrations in the August period were 0, 4.8 and 9 mg/L, respectively. The average concentration was 2.2 mg/L in the December period. In the December period, the range was from 0 to 7 mg/L.

Metals. The maximum aluminum concentration for all of the data was 4,700 micrograms per liter (4.70 mg/L). The maximum concentrations in the May, August and December periods were 730, 1,300 and 380 micrograms per liter. There is no maximum contaminant level for aluminum in drinking water. However, on two occasions in the August period, the aluminum concentration exceeded 1,000 micrograms per liter. The maximum concentration of 4,700 micrograms per liter was very large for aluminum in surface waters in Arkansas. Considerable variation in the data was apparent as a function of time and as a function of the season of the year. The magnitudes of the ranges were 710, 1,120 and 300 micrograms per liter for the three seasonal periods. The data were much more variable in the August period than in the May and December periods.

The maximum arsenic concentration was 8 micrograms per liter. For reference purposes, the maximum contaminant level for arsenic in drinking water is 50 micrograms per liter. The arsenic concentrations should not exceed 20 micrograms per liter for the protection of aquatic life. Consequently, the arsenic concentrations in the lake at this site would be considered small. The maximum arsenic concentrations were 2, 8 and 1 micrograms per liter in the May, August and December periods. The data were much more variable in the August period than in the May and December periods. The magnitudes of the ranges were 1, 7 and 1 micrograms per liter for the three seasonal periods.

The maximum chromium concentration for all data was 40 micrograms per liter. The maximum contaminant level for chromium in drinking water is 50 micrograms per liter. The chromium concentrations should not exceed the 10 to 15 micrograms per liter range for the protection of aquatic life. Although the chromium concentrations were all within acceptable levels for use as a drinking water supply, they were excessive on occasions in each of the three seasonal periods. The maximum concentrations were 20, 40 and 20 micrograms per liter in the May, August and December periods. The average concentrations were 9, 9 and 5 micrograms per liter for the three seasonal periods. The data were variable for all three seasonal periods. The magnitudes of the ranges were 20, 40 and 20 micrograms per liter for the three seasonal periods.

The minimum, average and maximum copper concentrations were 3, 5.4 and 12 micrograms per liter in the May period. In the August period, the minimum, average and maximum concentrations were 2, 3.8 and 5 micrograms per liter. The minimum, average and maximum in the December period were 0, 4.2 and 8 micrograms per liter. For all of the data, the minimum, average and maximum copper concentrations were 0, 4.7 and 12 micrograms per liter. The copper concentrations were small in the lake at this site. All of the concentrations were within acceptable levels for the protection of aquatic life. There was some variation in the data. The magnitudes of the ranges were 9, 3 and 8 micrograms per liter for the three seasonal periods. The copper concentrations were within acceptable levels for the protection of aquatic life.

The minimum, average and maximum iron concentrations for all of the data were 120, 3,450 and 33,000 micrograms per liter. The average concentrations were 1,080, 3,700 and 750 micrograms per liter in the May, August and December periods, respectively. These averages indicated significant seasonal variations. The maximum concentrations were 1,900, 33,000 and 1,600 micrograms per liter for the three seasonal periods. The minimum concentrations were 550, 120 and 250 micrograms per liter. The 33,000 micrograms per liter concentration was extremely large. It occurred in the sample collected at a depth of 3 feet on August 17, 1977. The iron concentrations were 1,000 micrograms per liter, or larger, on six occasions. For reference purposes, the recommended maximum contaminant level for drinking water is 0.3 mg/L. The data were variable for all three seasonal periods. The magnitudes of the ranges were 1,350, 32,880 and 1,350 micrograms per liter, respectively, in the May, August and December seasonal periods.

The maximum lead concentration found in the record was 33 micrograms per liter. The maximum concentrations for the seasonal data were 15, 4 and 4 micrograms per liter in the May, August and December periods. The average concentrations for lead were 6.6, 2.4 and 2.7 mg/L. The lead concentration of 33 micrograms per liter was more than three times the next largest lead concentration reported. Consequently, the lead concentrations were usually well within the new maximum contaminant level for drinking water. They were also usually within acceptable levels for the protection of aquatic life. The lead data were much more variable in the May period than in the August and December periods. The magnitudes of the ranges were 13, 3 and 2 mg/L for the three seasonal periods.

The minimum, average and maximum manganese concentrations for all of the data were 40, 490 and 4,900 micrograms per liter. In the May period, the minimum, average and maximum concentrations were 40, 280 and 1,700 micrograms per liter. In the August period, the minimum, average and maximum concentrations were 240, 1,250 and 4,900 micrograms per liter. The minimum, average and maximum concentrations were 100, 140 and 230 micrograms per liter in the December period. Thus, the average seasonal concentrations were 280, 1,250 and 140 micrograms per liter. These averages indicate a significant variation in manganese concentration with the season of the year. For reference purposes, the recommended maximum contaminant level for drinking water is 0.05 mg/L. The data were variable in the May and August periods. The magnitudes of the ranges were 1,660, 4,660 and 130 micrograms per liter for the three seasonal periods.

The maximum mercury concentration was 2.7 micrograms per liter for all of the data. The maximum mercury concentrations for the three seasonal periods were 0.3, 0.5 and 0.1 microgram per liter, respectively, in the May, August and December periods. The mercury concentrations in the three seasonal periods were all within acceptable levels for the protection of aquatic life. However, the peak concentration of 2.7 micrograms per liter was excessive. Since the peak concentration only occurred on one occasions, it may have been an anomaly. The mercury data were relatively consistent for all three seasonal periods. The magnitudes of the ranges were 0.3, 0.5 and 0.1 micrograms per liter.

Overall, the maximum nickel concentration was 16 micrograms per liter. The maximum nickel concentrations were 16, 5 and 5 micrograms per liter in the May, August and December periods. The average nickel concentrations were 5.8, 3.2 and 3.5 micrograms per liter for the three seasonal periods. These were very small concentrations and would not be considered significant in almost any context. They were well within acceptable levels for the protection of aquatic life. The data were variable particularly in the May period. The magnitudes of the ranges were 13, 3 and 3 micrograms per liter, respectively, in the May, August and December seasonal periods.

The potassium concentrations averaged 1.4, 2.1 and 1.7 mg/L in the May, August and December periods, respectively. The maximum concentrations were 2.0, 3.2 and 2.1 mg/L. Potassium is usually not a particularly significant water quality parameter. Potassium at concentrations this small would not be considered a significant parameter by almost any ground or surface water quality scale.

The recommended maximum contaminant level for zinc in public water supplies is 5 mg/L. The maximum zinc concentration for all of the data was 100 micrograms per liter. For the seasonal data, the maximum concentrations were 80, 100 and 50 micrograms per liter. Although these concentrations were larger than usually found in most lakes in Arkansas, they were well within acceptable levels for the protection of aquatic life. The data were variable for all three seasonal periods. The magnitudes of the ranges were 80, 100 and 40 micrograms per liter, respectively, in the May, August and December seasonal periods.

<u>Nitrogen</u>. The average un-ionized ammonia nitrogen was 0.0003 mg/L with the range from 0.0 to 0.002 mg/L for all of the data at this site. In the May period, the range was from 0 to 0.0006 mg/L with an average concentration of 0.0002 mg/L. The minimum, average and maximum concentrations were 0.0001, 0.0007 and 0.002 mg/L in the August period, respectively. The concentrations ranged from 0 to 0.0005 mg/L with an average concentration of 0.0002 mg/L for the December period. These concentrations were somewhat larger than usual for most large impounded surface waters in

Arkansas. However, all of the un-ionized ammonia concentrations were less than the EPA criterion of 0.02 mg/L for the protection of aquatic life. The data were more variable for all the August period than the May and December periods. The magnitudes of the ranges were 0.0006, 0.0019 and 0.0005 mg/L.

The average ammonia nitrogen concentrations were 0.12, 0.13 and 0.09 mg/L, respectively, in the May, August and December periods. Ammonia nitrogen concentrations ranged from 0.01 to 0.30 mg/L in the May period and from 0.01 to 0.40 mg/L in the August period. The range was from 0.02 to 0.34 mg/L in the December period. The data were variable for all three seasonal periods. The magnitudes of the ranges were 0.29, 0.39 and 0.32 mg/L.

Overall, the minimum, average and maximum Total Kjeldahl Nitrogen concentrations were 0.20, 0.64 and 2.3 mg/L. The average concentrations were 0.52, 0.78 and 0.63 mg/L in the May, August and December seasonal periods, respectively. The maximum concentrations were 0.87, 1.3 and 1.0 mg/L for the three seasonal periods. The magnitudes of the ranges were 0.57, 1.00 and 0.80 mg/L. The data were variable for all three seasonal periods.

The nitrate nitrogen concentrations averaged 0.08, 0.12 and 0.12 mg/L in the May, August and December periods. The maximum concentrations were 0.24, 0.49 and 0.24 mg/L for in the three seasonal periods. The minimum concentrations were 0.01, 0 and 0 mg/L for the spring, summer and winter seasons. As indicated by the seasonal average concentrations there was some seasonal variation in the nitrate concentrations. The magnitudes of the ranges were 0.23, 0.49 and 0.24 mg/L.

pH. The minimum, average and maximum pH values were 2.3, 6.9 and 8.3 units for all of the data. The very low pH value of 2.3 (for water) was almost certainly an error. It occurred at a depth of 25 feet in the June 19, 1989 profile. At a depth of 26 feet the pH was 6.1 units. In the May period, the minimum, average and maximum pH values were 5.9, 6.7 and 8.0 units. The minimum, average and maximum pH values in the August period were 5.8, 6.8 and 7.8 units. The minimum, average and maximum pH values were 6.2, 7.0 and 7.7 units in the December period. The average seasonal pH values were 6.7, 6.8 and 7.0 units which indicated some variation in the average values with respect to the season of the year. However, as shown by the pH profiles, the lower pH values at depth account for the smaller seasonal averages in the May and August periods. The magnitudes of the ranges were 2.0, 2.0 and 1.5 units for the three seasonal periods.

Phosphorous. The minimum, average and maximum concentrations were 0.01, 0.08 and 1.60 mg/L for all of the data. The total phosphorous concentration of 1.60 mg/L was extremely large for water in a lake such as Blue Mountain Lake. It occurred during the August period of 1977 and has not been repeated. In fact, it was ten times as large as the next largest concentration reported during the August period. In the May period, the minimum, average and maximum concentrations were 0.01, 0.05 and 0.11 mg/L. The minimum, average and maximum concentrations were 0.02, 0.11 and 1.60 mg/L, respectively, in the August period. The minimum, average and maximum concentrations were 0.01, 0.04 and 0.06 mg/L in the December period. Thus, the average seasonal concentrations were 0.05, 0.11 and 0.04 mg/L which indicated a significant seasonal variation. However, the seasonal average concentration for August was influenced by the very large concentration of 1.60 mg/L which was reported in the August period in 1977. The total phosphorous data were variable in the August period. The magnitudes of the ranges were 0.10, 1.58 and 0.05 mg/L. The total phosphorous concentrations were unusually large on several occasions for large unpolluted lakes at this site.

The maximum orthophosphate concentration for all of the data was 1.60 mg/L. For the seasonal data, the maximum concentrations were 0.09, 1.60 and 0.05 mg/L in the May, August and December periods. The average orthophosphate concentrations were 0.03, 0.07 and 0.02 mg/L. The large orthophosphate concentration of 1.60 mg/L occurred in the August, 1977 sample as did the very large total phosphorous concentration. The data were variable in the August period. The magnitudes of the ranges were 0.08, 1.60 and 0.05 mg/L. The orthophosphate concentrations were also larger than normal for large unpolluted lakes.

<u>Sulfate</u>. Regulation No. 2 issued by the Arkansas Department of Pollution Control and Ecology does not list a specific stream standard for the Petit Jean River. Consequently, the maximum allowable concentration is 250

mg/L with the provision that discharges do not increase the sulfate concentration in the stream by more than 15 mg/L or by 1/3 over naturally occurring levels, whichever is greater. Consequently, the limitation of an increase up to 15 mg/L is the controlling factor because of the small sulfate concentrations in the Petit Jean River. The maximum sulfate concentration in the record was 16 mg/L. Overall, the minimum and average sulfate concentrations were 2.0 and 8.7 mg/L. In the May period, the minimum, average and maximum concentrations were 2.0, 7.6 and 12.0 mg/L. The average sulfate concentration was 7.2 mg/L with the range from 5.0 to 10.0 mg/L in the August period. In the December period, the minimum, average and maximum concentrations were 5.0, 8.1 and 10.0 mg/L. Consequently, all of the sulfate concentrations were well within the applicable standard.

Temperature. The minimum, average and maximum temperatures were 0.5, 17.2 and 32.5 degrees Celsius for all of the data. The average seasonal temperature values were 20.2, 26.5 and 8.5 degrees Celsius for the three seasonal periods. The minimum temperatures were 13.5, 22.5 and 0.5 degrees Celsius in the May, August and December periods. The maximum temperatures were 30.5, 32.5 and 15.0 degrees Celsius. The specific standard for temperature in Blue Mountain Lake is 32 degrees Celsius.

Transparency. The minimum, average and maximum transparency values were 1, 24 and 216 inches for all of the data. The minimum, average and maximum values were 8, 22 and 50 inches in the May data. In the August data, the minimum, average and maximum values were 2, 21 and 42 inches in the August data. The minimum, average and maximum values were 11, 24 and 50 inches, in the December data. Thus, the average seasonal transparency values were 22, 21 and 24 inches. The magnitudes of the ranges were 42, 40 and 39 inches, respectively, in the May, August and December seasonal periods. Although there is no specific standard for transparency, it is ordinarily desirable to have a transparency of forty-eight inches based on the Secchi disk measurement for waters used in primary contact recreation. Based on this criterion, the water in Blue Mountain Lake at the Waveland site would not be considered to have good clarity.

With respect to transparency, in the May period, only one of the twenty-three transparency values exceeded forty-eight inches. None of the twenty-two values reported for the August period equalled or exceeded forty-eight inches. The maximum in the August period was forty-two inches. Only one of the twenty transparency values exceeded forty-eight inches in the December period.

Turbidity. The minimum, average and maximum turbidity values were 3.5, 25 and 300 FTU for all of the data. The maximum turbidity values for the seasonal data were 82, 32 and 42 FTU, respectively, in the May, August and December periods. The minimum turbidity values were 6.6, 4.5 and 3.8 FTU for the three seasonal periods. The average turbidity values were 26, 16 and 16 FTU. Although the average turbidity value of 26 FTU indicated a relatively turbid water, the average was influenced significantly by several larger values, particularly in samples collected at 0.8 depth. The data were variable for all three seasonal periods. The magnitudes of the ranges were 75.4, 27.5 and 38.2 units.

Station Number 3 (Ashley Creek Site). The figures showing the data graphically for this site are included in Appendix C. Summaries of the statistical analyses are included in Tables XV, XVI and XVII.

Alkalinity. The minimum, average and maximum total alkalinity concentrations were 6, 17 and 46 mg/L for all of the data. The average seasonal total alkalinity concentrations were 13, 21 and 18 mg/L in the May, August and December periods. Although variable, the total alkalinity concentrations in the May period have tended to remain about the same. That is, no apparent long-term increases or decreases in the total alkalinity concentrations were apparent. In the August period, a peak concentration of 46 mg/L was reported in 1977. The alkalinity concentrations increased from 1979 through 1983 and have been nearly constant since. The alkalinity concentrations have been variable in the December period and no long-term trends for changes were evident.

The minimum concentrations were 9, 14 and 11 mg/L for the May, August and December periods. The maximum concentrations were 18, 46 and 26 mg/L in the May, August and December periods. The data are shown in Figures C1, C2 and C3. The alkalinity concentrations were all within acceptable levels at all times.

Five-Day Biochemical Oxygen Demand. The minimum, average and maximum five-day biochemical oxygen demand concentrations were 0.6, 2.0 and 3.4 mg/L for all data. The minimum, average and maximum five-day biochemical oxygen demand concentrations were 1.3, 2.1 and 2.7 mg/L for the data collected in the May period. In the August period, the minimum, average and maximum concentrations were 1.5, 2.4 and 3.4 mg/L. The minimum, average and maximum concentrations in the December period were 0.6, 1.6 and 2.7 mg/L. The data are shown graphically in Figures C4, C5 and C6.

The five-day biochemical oxygen demand concentrations were not remarkable and were representative of those expected in lakes in Arkansas. The minimum five-day biochemical oxygen demand concentrations were slightly larger than in some other lakes in Arkansas, but the concentrations were so small that these differences were subtle. The five-day biochemical oxygen demand concentrations have generally been mixed in the samples collected during the May and August periods. A tendency for decreasing five-day biochemical oxygen demand concentrations was apparent in the August period from 1985 until 1987. The five-day biochemical oxygen demand concentrations in the December period increased from 1987 until 1989.

Chloride. The minimum, average and maximum concentrations for all of the data were 0, 2.6 and 7 mg/L. Only five chloride concentrations were reported at the Ashley Creek site.

Chlorophyll a. The samples analyzed for chlorophyll a were all collected at the three foot depth. The minimum, average and maximum chlorophyll a concentrations for all of the data were 0.2, 7.2 and 41.0 micrograms per liter, respectively. In the May season, the minimum, average and maximum chlorophyll a concentrations were 0.5, 6.7 and 29.0 micrograms per liter. The minimum, average and maximum concentrations in the August period were 1.7, 13.7 and 41.0 micrograms per liter. The minimum, average and maximum concentrations in the December period were 0.2, 2.3 and 10.0 micrograms per liter. The data are shown graphically in Figures C7, C8 and C9. Thus, the seasonal averages were 6.7, 13.7 and 2.3 micrograms per liter. As indicated by these averages, there was a significant difference among the seasonal averages.

In the May period, the chlorophyll a concentrations peaked in 1986 and have generally been decreasing since. In the August period, the chlorophyll a concentrations peaked in 1985 and have been declining since. The chlorophyll a concentrations have been small and relatively constant in the December period. An unusually large peak (for the December period) did occur in 1989.

Chlorophyll b. The minimum, average and maximum chlorophyll b concentrations in the May period were 0.1, 0.4 and 1.2 micrograms per liter. In the August period, the minimum, average and maximum concentrations were 0.1, 0.7 and 2.0 micrograms per liter. The minimum, average and maximum in the December period were 0.1, 0.3 and 1.5 micrograms per liter. The minimum, average and maximum chlorophyll b concentrations for all data were 0.1, 0.5 and 2.0 micrograms per liter.

The seasonal data are shown graphically in Figures C10, C11 and C12. As shown by Figure C10, the chlorophyll b concentrations have generally been decreasing since 1986 for the May period. This trend parallels the same type of trend for the chlorophyll a concentrations. In the August period, however, the chlorophyll b concentrations were much larger in 1986, 1987 and 1988 than in prior or subsequent years. Prior to 1986 the chlorophyll b concentrations had been small and consistent. The large chlorophyll b concentrations in 1986 through 1989 occurred at a time when the chlorophyll a concentrations were decreasing. In the December period, the chlorophyll b concentrations had been small and relatively consistent until a large peak concentration of 1.5 micrograms per liter occurred in 1989.

<u>Color</u>. Figures C13, C14 and C15 show the color data for the three seasonal sampling periods. As shown by the three figures, the color concentrations varied as a function of the season of the year and as a function of time.

The color concentrations have been relatively large for parts of the May and December periods and on one occasion in the August period. The general rule of thumb is that the color concentration should not exceed 50 units. The concern is that color in excess of 50 units may limit photosynthesis and may have a deleterious effect upon certain aquatic life, particularly phytoplankton and the benthos. The color concentrations have been mixed in the May period. From 1978 until 1981, the trend was for increasing color concentrations as a function of time. Conversely, the color concentrations decreased from 1981 until 1985. The color concentrations were constant at 100 units from 1986 through 1988. In the May period, the color concentrations equalled or exceeded 50 units in 9 of the 14 samples for which data were reported.

In the August period, the largest color concentration, 120 units, occurred in 1977 with the data for all subsequent years being significantly smaller. Decreasing trends were evident for 1980 through 1984 and from 1986 through 1990. Of the twelve color concentrations reported in the August period, only two equalled or exceeded 50 units.

Of the ten color concentrations reported in the December period, four equalled or exceeded 50 units. Two large color concentrations occurred in 1980 and 1985 in the December period. Both were reported as 120 units. The trend generally was for increasing color until 1985. However, the color concentrations have been decreasing since 1985.

Combined, the color data in the August and December periods suggest the quality of water in the lake at this site was improving, particularly in recent years. There was too much scatter in the data in the May period to allow estimation of long term trends. Clearly, color needs to be monitored closely at this site.

Conductivity. Figures C16, C17 and C18 show the conductivity data for the three seasonal periods. As shown by these figures, the conductivity values in Blue Mountain Lake were relatively small. The average conductivity values were 61, 73 and 81 micromhos per centimeter for the three seasonal periods. The maximum conductivity values were 78, 120 and 130 micromhos per centimeter. The minimum values were 50, 61 and 39 micromhos per centimeter. The seasonal averages indicated a significant seasonal influence on the conductivity values. The data in the May period indicated the conductivity values were relatively constant. There was a long-term pattern of slightly decreasing conductivity values in the August period. The data in the December period can be characterized as being highly variable.

Reservoir Depth. Figures C19, C20 and C21 show the depth of water at the time of sampling for each season.

Dissolved Oxygen. The seasonal data are shown in Figures C22, C23 and C24. The minimum, average and maximum concentrations for all data were 2.8, 8.8 and 13.7 mg/L. The minimum, average and maximum dissolved oxygen concentrations in the May period were 2.8, 8.2 and 10.8 mg/L. In the August period, the minimum, average and maximum concentrations were 4.4, 7.1 and 8.8 mg/L. The minimum, average and maximum concentrations in the December period were 8.0, 11.1 and 13.7 mg/L. The dissolved oxygen concentration of 2.8 mg/L in the May period occurred when the reservoir was unusually full. Since the sample was collected at one-half depth, the effects of stratification undoubtedly influenced this concentration. On the other hand, the sample with the smallest dissolved oxygen concentration during the August period occurred when the lake level was lower than usual. The sample was collected at a depth of one foot. Consequently, it can be assumed that the dissolved oxygen concentration was about what it would have been in a sample collected at the surface. Except for the sample containing 2.8 mg/L of dissolved oxygen, all of the samples collected in the May period had excellent dissolved oxygen concentrations. Most contained 8.0 mg/L or more of dissolved oxygen. In the August period, three of the twelve samples had dissolved oxygen concentrations less than 6.0 mg/L. These were 4.4, 5.7 and 5.8 mg/L.

Since 1984, the dissolved oxygen concentrations have generally been increasing in the December period. They had also generally been increasing from 1983 until 1989 in the May period. The small dissolved oxygen concentration in the sample collected during the May period in 1990 was remarkable in that it was unusually small for this period at this site. However, the lake had not been as full in prior years. The dissolved oxygen concentrations, expressed as a percent of saturation, are shown in Figures C25, C26 and C27.

Fecal Coliform. Figures C28, C29 and C30 show the seasonal data plotted as a function of time in the May, August and December periods. The maximum fecal coliform counts were 700, 57 and 1,100 colonies per 100 mL. The average fecal coliform counts were 110, 14 and 160 colonies per 100 mL. Blue Mountain Lake and the Petit Jean River are designated as primary contact waters. Consequently, the applicable standard based on Regulation No. 2 is a geometric mean of 200 colonies per 100 mL for the period between April 1 and September 30. Additionally, the fecal coliform count shall not exceed 400 colonies per 100 mL in more than 10 percent of the samples in any one month. For the period of the year from October 1 until March 31, the applicable standard is a geometric mean of 1,000 colonies per 100 mL and a maximum of 2,000 colonies per 100 mL in more than 10 percent of the samples taken in any 30-day period.

Three fecal coliform counts were relatively large. These were 700 colonies per 100 mL in the May period of 1984, 1,100 colonies per 100 mL in the December period in 1980 and 280 colonies per 100 mL in the May period of 1986. These concentrations were troublesome. Fortunately, however, the fecal coliform counts in recent years have been quite small and well within the standards for primary contact recreation. Additionally, the data in the December period indicated a generally decreasing trend for fecal coliform since 1987.

Hardness. The total hardness data in the May, August and December seasonal samples are shown in Figures C31, C32 and C33 at the Ashley Creek site. As shown by these figures, the total hardness concentrations in the samples collected were small. Consequently, the water would be considered soft. The minimum, average and maximum total hardness concentrations for all of the data were 12, 21 and 38 mg/L (expressed as calcium carbonate). In the May period, the minimum, average and maximum concentrations were 13, 17 and

22 mg/L. The minimum, average and maximum concentrations in the August period were 12, 20 and 38 mg/L. In the December period, the minimum, average and maximum concentrations were 12, 21 and 31 mg/L. The seasonal averages of 17, 20 and 21 mg/L did indicate some variation with respect to seasons of the year. As shown in Figure C32, the general trend in the August period has been for decreasing total hardness concentrations as a function of time. The total hardness concentrations have generally been decreasing since 1981 in the May period. The December period data were variable.

The calcium data are shown in Figures C34, C35 and C36. The maximum calcium concentrations were 13, 20 and 10 mg/L (expressed as calcium carbonate) in the May, August and December periods. As shown in Figure C35, the calcium concentrations generally decreased from 1977 through 1983 for the August period. They also decreased from 1978 through 1980 and from 1981 through 1983 in the May period. The average calcium concentrations were 9, 11 and 9 mg/L in the May, August and December periods, respectively. The maximum concentrations were 13, 20 and 10 mg/L.

The dissolved calcium concentrations are shown in Figures C37, C38 and C39 for the three seasonal periods. As shown by Figure C37, the dissolved calcium concentrations have generally decreased since 1978 in the May period. In the August period, the data were relatively constant except for two concentrations. These were in 1980 and 1987. The data in the December period were also relatively constant except for a peak concentration in 1987. The minimum, average and maximum concentrations were 0, 3.5 and 5.9 mg/L for all of the data. The average concentration was 3.0 mg/L in the May period with a range in concentration from 0 to 5.1 mg/L. In the August period, the average concentration was 3.4 mg/l and the range from 1.2 to 5.0 mg/L. The minimum, average and maximum concentrations in the December period were 3.1, 4.1 and 5.9 mg/L, respectively.

The dissolved magnesium data are shown in Figures C40, C41 and C42. The maximum dissolved magnesium concentrations were 2.5, 2.8 and 5.3 mg/L in the May, August and December periods, respectively. As indicated by these figures, there is very little magnesium in the water. The average concentrations were 1.8, 2.3 and 3.8 mg/L which indicated some variation with respect to seasons of the year. The data for the May and August periods was relatively consistent. The December period data were more variable.

The noncarbonate hardness concentrations ranged from 2 to 14 mg/L for all of the data. The overall average was 7.8 mg/L. The maximum noncarbonate hardness concentrations were 6, 7 and 14 mg/L, respectively, in the May, August and December periods. The noncarbonate hardness data are shown in Figures C43, C44 and C45.

Nitrogen. The minimum, average and maximum nitrate nitrogen concentrations were 0.02, 0.11 and 0.28 mg/L for all data. In the May period, the minimum, average and maximum concentrations were 0.02, 0.08 and 0.10 mg/L. The minimum, average and maximum concentrations were 0.02, 0.07 and 0.10 mg/L in the August period. In the December period, the minimum, average and maximum concentrations were 0.02, 0.17 and 0.28 mg/L. The average seasonal concentrations were 0.08, 0.07 and 0.17 mg/L which indicated significant variation with respect to the season of the year. The average concentration was larger in the December period than in the May and August periods. This was ordinarily the case.

Except for smaller nitrate nitrogen concentrations in 1988 and 1989, the concentrations were constant in the May period. Similarly, the nitrate nitrogen concentrations were constant in the August period, except for smaller concentrations in 1989 and 1990. The data were more variable in the December period, particularly in the samples collected during the past three years. The data are shown graphically in Figures C46, C47 and C48.

pH. Figures C49, C50 and C51 show the pH values for the three seasonal periods. As shown by these figures, the pH values were all within the limits established by the Arkansas Department of Pollution and Control in Regulation No. 2. These limits are a minimum pH of 6 and a maximum pH of 9 units.

The minimum, average and maximum pH values were 6.0, 7.0 and 8.2 units for all of the data. In the May period, the minimum, average and maximum pH values were 6.0, 6.8 and 7.3 units. The minimum, average and maximum pH values in the August period were 6.2, 7.2 and 8.2 units. The minimum, average and maximum pH values, were 6.8, 7.1 and 7.7 units in the December period. The average seasonal values were

6.8, 7.2 and 7.1 units, respectively, in the May, August and December periods.

As shown by Figures C49, C50 and C51, the changes in pH were relatively small. In general, the tendency was for the pH values to remain relatively constant over the period of record. That is, there were no apparent trends for either long-term increasing or decreasing pH values. In all cases, the pH values were near neutral.

Phosphorous. Figures C52, C53 and C54 show the total phosphorous data for the three seasonal periods. The minimum, average and maximum concentrations were 0.01, 0.06 and 0.20 mg/L for all of the data. In the May period, the minimum, average and maximum concentrations were 0.01, 0.07 and 0.20 mg/L. The minimum, average and maximum concentrations were 0.03, 0.06 and 0.07 mg/L in the August period. The minimum, average and maximum concentrations were 0.02, 0.05 and 0.07 mg/L in the December period. The average seasonal concentrations were 0.07, 0.06 and 0.05 mg/L which indicated little seasonal variation. As shown by Figure C52, a peak total phosphorous concentration occurred in the May period of 1989. This concentration was 0.20 mg/L which was about three times as large as any other concentration reported for any of the three seasonal periods. Since phosphorous is one of the nutrients and because this concentration greatly exceeded any other, it does cause some concern. However, the total phosphorous concentration for 1990 in the May period was much smaller than average. Consequently, the peak concentration in 1989 may have been an anomaly and may not be particularly significant in the long term. A slight tendency for increasing total phosphorous concentrations as a function of time was evident for the August period. The data in the December period were variable. The total phosphorous concentrations were often larger than usual for large unpolluted lakes at this site.

The orthophosphate concentrations in the May, August, and December periods are shown in Figures C55, C56 and C57. The maximum orthophosphate concentration for all of the data was 0.05 mg/L. For the seasonal data, the maximum concentrations were 0.05, 0.03 and 0.03 mg/L for the three seasonal periods. The May period average reflects much larger orthophosphate concentrations in the samples collected in 1988 and 1989. A general trend for decreasing orthophosphate concentrations as a function of time in the August period was evident since 1985. The orthophosphate data in the December period have been relatively constant. The orthophosphate concentrations were often larger than usual for large lakes.

Temperature. Figures C58, C59 and C60 show the seasonal data for the three periods. The minimum, average and maximum temperatures were 2.3, 19.3 and 33.5 degrees Celsius for all of the data. The average seasonal temperature values were 21.9, 30.0 and 8.0 degrees Celsius for the three seasonal periods. The minimum temperatures were 17.0, 25.5 and 2.3 degrees Celsius in the May, August and December periods. The maximum temperatures were 26.5, 33.5 and 12.5 degrees

Celsius. The specific standard for temperature in Blue Mountain Lake is 32 degrees Celsius.

Transparency. Figures C61, C62 and C63 show the transparency data for the three seasonal periods. The minimum, average and maximum transparency values were 6, 23 and 144 inches for all of the data. The minimum, average and maximum values were 7, 18 and 49 inches in the May data. In the August data, the minimum, average and maximum values were 6, 11 and 20 inches in the August data. The minimum, average and maximum values were 6, 24 and 72 inches, in the December data. The transparencies indicate a water that does not have good clarity. For safety purposes, the general guideline is for a minimum transparency of forty-eight inches for water used for primary contact recreation. In the May period, only one transparency value equalled or exceeded the recommended transparency. None of the transparency values in the August period were at or above the minimum transparency value. One of the transparency values satisfied the recommended minimum in the December period. Figure C63 indicated increasing transparency values since 1987 in the December period. Whether this trend will continue cannot be determined at this time.

Turbidity. Figures C64, C65 and C66, show the turbidity data at the Ashley Creek site. The minimum, average and maximum turbidity values were 0, 22 and 100 FTU for all of the data. The maximum turbidity values for the seasonal data were 38, 29 and 40 FTU in the May, August and December periods. The minimum turbidity values were 0, 5.7 and 4.4

FTU for the three seasonal periods. The average turbidity values were 19, 16 and 19 FTU. The specific standard for turbidity in Blue Mountain Lake as established by the Arkansas Department of Pollution Control and Ecology is 25 NTU. This standard has been exceeded in all three seasonal periods. For example, five of the fourteen turbidity values reported in the May period exceeded 25 FTU. Two of the eleven values in the August period equalled or exceeded 25 FTU. Three of the ten values in the December period exceeded the specific standard for turbidity.

Station Number 4 (Sugar Grove Site). The figures showing the data graphically for this site are included in Appendix D. Summaries of the statistical analyses are included in Tables XVIII, XIX and XX. At this site, samples were collected and analyzed for several parameters at the 0.2 and 0.8 depth levels. The parameters included total alkalinity, five-day biochemical oxygen demand, chloride, color, conductivity, dissolved oxygen, total hardness, calcium, dissolved calcium, dissolved magnesium, nitrate nitrogen, pH, total phosphorous, orthophosphate, sulfate, temperature and turbidity.

Alkalinity. Figures D1, D2, and D3 show the total alkalinity data for the three seasonal periods. The average seasonal total alkalinity concentrations were 16, 31 and 17 mg/L in the May, August and December periods. The overall average concentration was 21 mg/L. The minimum and maximum alkalinity concentrations were 8 and 25 mg/L in the May period. In the August period, the total alkalinity concentrations ranged from 15 to 54 mg/L. Minimum and maximum alkalinity concentrations in the December period were 9 and 41 mg/L.

Generally, the total alkalinity concentrations in the samples collected at 0.8 depth were less than the concentrations for the 0.2 depth samples in the May period. There was no consistent pattern in the August period in this regard. That is, sometimes the total alkalinity concentrations in the samples collected at 0.8 depth were greater than in the 0.2 depth samples and sometimes less. There was no consistent long-term pattern with respect to increasing or decreasing total alkalinity concentrations for any of the three seasonal periods.

Five-Day Biochemical Oxygen Demand. The seasonal data are shown in Figures D4, D5 and D6. The maximum five-day biochemical oxygen demand concentration was 7.8 mg/L for all of the data. This concentration was unusually large for a large lake in Arkansas. The overall average concentration was 2.3 mg/L with minimum and maximum concentrations of 0.2 and 7.8 mg/L. The average seasonal five-day biochemical oxygen demand concentrations were 2.0, 2.7 and 1.9 mg/L. The minimum and maximum concentrations in the May period were 0.4 and 6.6 mg/L. In the August period, the minimum and maximum concentrations were 0.2 and 7.8 mg/L. The minimum and maximum in the December period were 0.4 and 3.6 mg/L.

The data in the August period indicated the five-day biochemical oxygen demand concentrations have been variable.

No consistent long-term pattern was evident either for five-day biochemical oxygen demand as a function of time or as a function of depth in the May and August periods. For the samples collected at 0.2 depth, the five-day biochemical oxygen demand concentrations have been decreasing since 1986 in the May period. Until 1988, the trend had been for decreasing five-day biochemical oxygen demand concentrations as a function of time in the December period. Except for the five-day biochemical oxygen demand concentration of 6.6 mg/L which occurred in the sample collected at 0.8 depth in 1990, the data in the May period were only somewhat larger than usual for a large lake in Arkansas. However, four relatively large five-day biochemical oxygen demand concentrations have been reported in the August period. These were 7.8 mg/L for the 1977 sample, 6.0 mg/L for the 1979 sample, 4.7 mg/L for the 1990 sample and 4.0 mg/L for the 1986 sample. All four concentrations were in the samples collected at 0.2 depth. These were unusually large five-day biochemical oxygen demand concentrations for such a surface water resource as Blue Mountain Lake. Consequently, they were of concern. Fortunately, the two largest concentrations occurred in earlier years.

Chloride. The minimum, average and maximum concentrations for all of the data were 0, 4.5 and 9.0 mg/L. These chloride concentrations were very small compared with the recommended drinking water limit of 250 mg/L and were less than the stream standard which is a maximum of 15 mg/L over natural chloride levels with a cap of 250 mg/L.

Figures D7, D8 and D9 in Appendix D show the chloride concentrations as a function of time for the three seasonal sampling periods. The minimum, average and maximum chloride concentrations in the May period were 0, 2.6 and 5.0 mg/L. In the August period, the minimum, average and maximum concentrations were 1.0, 4.3 and 8.0 mg/L. In the December period, the minimum, average and maximum concentrations for were 4.0, 5.4 and 7.0 mg/L. The average seasonal concentrations were 2.6, 4.3 and 5.4.

Figure D7 indicated the chloride concentrations decreased until 1980, but generally increased from 1980 through 1983. The sample collected in 1983 represents the most recent data in the May period. In the August period, an overall trend for decreasing chloride concentrations as a function of time was evident. The chloride concentrations increased from 1980 through 1983 in the December period. All of the chloride concentrations were small. They were well within the applicable standard for the Petit Jean River.

<u>Chlorophyll a</u>. The minimum, average and maximum chlorophyll a concentrations for all of the data were 0.3, 8.7 and 33.0 micrograms per liter, respectively. In the May season, the minimum, average and maximum chlorophyll a concentrations were 0.7, 7.0 and 15.0 micrograms per liter. The minimum, average and maximum concentrations in the August period were 2.0, 17.1 and 33.0 micrograms per liter. The minimum, average and maximum concentrations in the December

period were 0.3, 3.5 and 21.0 micrograms per liter. The data are shown graphically in Figures D10, D11 and D12.

The average seasonal chlorophyll a concentrations were 7.0, 17.1 and 3.5 micrograms per liter, respectively, for the May, August and December periods. The chlorophyll a concentrations exhibited a general trend for increasing concentrations until 1987 in the August period. However, the sample collected in 1989 had a much smaller chlorophyll a concentration. The chlorophyll a concentration in the sample collected in 1990 was larger than in the 1989 samples in the August period. The chlorophyll a concentration averaged 0.6 mg/L in the December period until the concentration for 1990 was included. The concentration in the 1990 sample was 21 micrograms per liter which raised the average to 3.5 micrograms per liter. The large concentration in the December period of 1990 and the large concentrations from 1985 through 1987 were of concern. Monitoring of chlorophyll a for several years is needed to determine whether this concentration is an indicator of future problems.

Chlorophyll b. The minimum, average and maximum chlorophyll b concentrations in the May period were 0.1, 0.4 and 1.4 micrograms per liter. In the August period, the minimum, average and maximum concentrations were 0.1, 1.4 and 3.0 micrograms per liter. The minimum, average and maximum in the December period were 0.1, 0.1 and 0.4 micrograms per liter. The minimum, average and maximum chlorophyll b concentrations for all data were 0.1, 0.6 and 3.0 micrograms per liter for all of the data. The seasonal data are shown graphically in Figures D13, D14 and D15.

The average seasonal concentrations were 0.4, 1.4 and 0.1 micrograms per liter in the May, August and December periods which indicated significant seasonal variations. Figure D13 shows the peak concentration in the May period of 1987 paralleling the chlorophyll a concentration for this sample. The figure also shows a general pattern for decreasing chlorophyll b concentrations in the May period since 1987. The chlorophyll b concentrations tend to be much larger during the August period than in the May and December periods. As shown by Figure D14, two peak chlorophyll b concentrations occurred in 1983 and 1986. Both were near or at 3.0 micrograms per liter which was unusually large for chlorophyll b concentrations. The December data were constant at 0.1 micrograms per liter until the concentration for the sample collected in 1990 was measured. This concentration was 0.4 micrograms per liter which was four times as large as for the data for the previous years. Both the August and December period data indicated that additional monitoring is required.

Color. The color data for the three seasonal sampling periods are shown in Figures D16, D17 and D18. As indicated by the figures, the color concentrations varied considerably both as a function of time and as a function of the season of the year. The overall average color concentration was 49 units which was relatively large color concentration. The rule of thumb is that color ought not to exceed 50 units.

The minimum and maximum concentrations were 5 and 230 units. The minimum, average and maximum concentrations in the May period were 5, 45 and 100 units. In the August period, the minimum, average and maximum concentrations were 5, 32 and 80 units. The minimum, average and maximum concentrations in the December period were 5, 67 and 230 units. The average seasonal color concentrations were 45, 32 and 67 units. These averages reflect significant seasonal variation.

The general trend has been for decreasing color concentrations since 1980 in the December period. The trend has been for variable, but relatively large, color concentrations in the May and August periods. The data in the August period suggests that the color concentrations have been generally increasing since 1984.

Of the twenty-five color concentrations reported in the May period, twelve equalled or exceeded 50 units. In the August period, five of the seventeen concentrations equalled or exceeded 50 units. Twelve of the nineteen color concentrations reported in the December period exceeded 50 units. Fortunately, most of the larger color concentrations, but not all, occurred in earlier years. However, color clearly needs to be monitored for some time.

<u>Conductivity</u>. Figures D19, D20 and D21, show the conductivity data for the three seasonal periods. As shown by these figures, the conductivity values are variable both as a function of time and as a function of depth. The conductivity values for the samples collected at 0.8 depth were less than in the samples collected at 0.2 depth in the May

period. In the August period, the conductivity values in the samples collected at 0.8 depth were usually larger than in the samples collected at 0.2 depth. There were only nominal differences in the conductivity values collected at the two depths in the December period data.

The minimum, average and maximum conductivity values were 32, 79 and 165 micromhos per centimeter for all of the data. The minimum, average and maximum values in the May period were 32, 60 and 97 micromhos per centimeter. In the August period, the minimum, average and maximum values were 52, 96 and 159 micromhos per centimeter. The minimum, average and maximum values in the December period were 35, 69 and 130 micromhos per centimeter. The average seasonal conductivity concentrations were 60, 96 and 69 micromhos per centimeter.

The trend has been for relatively constant conductivity values since 1980 in the December period. The peak conductivity value in the December period of 130 micromhos per centimeter has not been repeated in the December period. There has been a general trend for increasing conductivity values in the samples collected at 0.8 depth in the August period. The data were scattered for the samples collected at 0.2 depth in the August period. The conductivity values have been decreasing for the past four years in the May period.

Reservoir Depth. The depth of water at this site is shown in Figures D22, D23 and D24 as a function of time.

Dissolved Oxygen. The dissolved oxygen concentrations are for samples collected at 0.2 and 0.8 depths. The seasonal data for the three periods are shown in Figures D25, D26 and D27, respectively. As shown by the figures, the dissolved oxygen concentrations in the August data were adversely affected by the stratification occurring in the lake at this site. On occasion, the dissolved oxygen concentrations in the samples collected at the two depths were substantially different in the May period. Usually, however, the two concentrations were about the same.

The minimum, average and maximum concentrations for all of the data were 0.1, 6.9 and 13.1 mg/L. The minimum, average and maximum dissolved oxygen concentrations in the May data were 0.1, 6.6 and 9.1 mg/L. In the August data, the minimum, average and maximum concentrations were 0.1, 3.9 and 9.0 mg/L. The minimum, average and maximum concentrations in the December period were 2.9, 10.1 and 13.1 mg/L. The dissolved oxygen concentrations have been generally increasing in the December period since 1984. They have been decreasing in the December period throughout the period of record. The data were variable in the August period for the samples collected at 0.2 depth. For the samples collected at 0.8 depth, the dissolved oxygen concentrations have been relatively small. The dissolved oxygen concentrations, expressed as percent of saturation, are shown in Figures D28, D29 and D30 for the three seasonal periods.

Fecal Coliform. The fecal coliform concentrations in the seasonal data at this site have been large on two occasions in the May period and on three occasions in the December period. The maximum concentration was 7,500 colonies per 100 mL which indicated a polluted water with respect to this parameter. A second peak of 700 colonies per 100 mL occurred in 1989 in the May period. The three largest fecal coliform counts in the December period were 5,800 in 1980, 1,700 in 1983 and 1,400 in 1985. The fecal coliform counts have exceeded 200 colonies per 100 mL for the May period on five occasions. Although the tendency for large fecal coliform counts did not occur each year, it is obviously of concern. The May period is within the time of the year when primary contact recreation occurs. Although the fecal coliform counts were small in 1987, 1988 and 1990 in the May period, continued monitoring is required to insure the safety of those participating in primary contact recreation.

The fecal coliform counts were all 170 colonies per 100 mL or less in the August period. Consequently, the large fecal coliform counts appear to be associated with the May and December periods. This suggested the possibility of fecal coliform organisms being washed into the lake with the spring and winter rains.

The minimum, average and maximum counts were 1, 780 and 7,500 colonies per 100 mL in the May period. The average fecal coliform count was 43 colonies per 100 mL in the August period with the range from 0 to 170 colonies per 100 mL. The minimum, average and maximum fecal coliform concentrations were 3, 940 and 5,800 in the December period. The fecal coliform data are shown in Figures D31, D32 and D33.

Hardness. The total hardness data for the three seasonal samples are shown in Figures D34, D35 and D36 at the Sugar Grove site. The minimum, average and maximum total hardness concentrations were 10, 23 and 110 mg/L for all of the data. The minimum, average and maximum concentrations in the May period were 10, 16 and 28 mg/L. In the August period, the minimum, average and maximum concentrations were 15, 32 and 110 mg/L. In the December period, the minimum, average and maximum concentrations were 14, 19 and 36 mg/L. The trend was for the total hardness concentrations in the samples collected at 0.8 depth to be smaller than in the samples collected at 0.2 depth in the May period. Otherwise, the total hardness concentrations remained about the same in the May period as a function of time. One remarkable concentration was the peak concentration of 110 mg/L which occurred in the sample collected at 0.2 depth in the August period of 1982. This concentration was more than three times as large as any prior or subsequent concentration. The remainder of the data in the August period were variable with no overall long-term pattern of decreasing or increasing hardness concentrations. The total hardness concentrations in the December period were relatively consistent throughout the period of record. The total hardness concentrations were small in the December period.

The calcium data are shown graphically in Figures D37, D38 and D39. As shown by Figure D37 in the May period, the calcium concentrations were smaller in the samples collected at 0.8 depth than in the samples collected at 0.2 depth.

There was also a general trend for decreasing calcium concentrations as a function of time in the May period. Except for the peak calcium concentration of 75 mg/L which occurred in the August period of 1982, the general trend was for decreasing calcium concentrations as a function of time in the August period. The general trend was also for decreasing calcium concentrations as a function of time in the December period. Including all of the data, the minimum, average and maximum calcium concentrations were 4, 12 and 75 mg/L, respectively. The average concentration in the May period was 8 mg/L with a range from 4 to 14 mg/L. The range was from 7 to 75 mg/L in the August period with an average concentration of 19 mg/L. The minimum and maximum concentrations were 6 and 18 mg/L in the December period. The average in the December period was 9 mg/L.

The dissolved calcium data are shown in Figures D40, D41 and D42. The minimum, average and maximum dissolved calcium concentrations for all of the data were 1.8, 4.5 and 30 mg/L (expressed as calcium). In the May period, the minimum, average and maximum concentrations were 1.8, 3.4 and 5.7 mg/L. In the August period, the minimum, average and maximum concentrations were 1.8, 7.1 and 30. The minimum, average and maximum concentrations in the December period were 2.5, 3.6 and 7.0 mg/L. Thus, the seasonal averages were 3.4, 7.1 and 3.7. The trends in the May and December periods were for the dissolved calcium concentrations to remain about the same as a function of time. The data were more variable in the August period.

The dissolved magnesium data are shown in Figures D43, D44 and D45. As shown by these figures, the magnesium concentrations in the water were very small. The minimum, average and maximum concentrations for all of the data were 1.2, 2.7 and 7.80 mg/L. In the May period, the minimum, average and maximum concentrations were 1.20, 2.1 and 3.4 mg/L. In the August period, the minimum, average and maximum concentrations were 1.9, 3.8 and 7.8 mg/L. The minimum, average and maximum concentrations were 1.80, 2.6 and 4.4 mg/L in the December period. The dissolved magnesium concentrations have been variable for both the May and December periods. In the May period, the dissolved magnesium concentrations in the samples collected at 0.8 depth have been smaller than in the samples collected at 0.2 depth. In the December period, the concentrations in the samples collected at the two depths have been about the same. There has been a general trend for increasing magnesium concentrations as a function of time since 1983 in the August period.

The noncarbonate hardness data are shown in Figures D46, D47 and D48. The maximum noncarbonate hardness concentration was 14 mg/L. The data were insufficient to warrant the drawing of conclusions.

<u>Metals</u>. Figures D49, D50 and D51 show the seasonal data for aluminum. The maximum aluminum concentration for all of the data was 3,8000 micrograms per liter (3.80 mg/L). The maximum concentrations in the May, August and December periods were 710, 1,000 and 660 micrograms per liter. The general trend was for increasing aluminum concentrations as a

function of time in the May period. The sample collected in 1981 was the most recent in the May period. Conversely, the aluminum concentrations in the samples collected at 0.8 depth were generally decreasing in the August period. They were variable for the samples collected at 0.2 depth in the August period.

All of the arsenic concentrations were 2 micrograms per liter or less. For reference purposes, the maximum contaminant level for arsenic in drinking water is 50 micrograms per liter. Consequently, the arsenic concentrations would be considered very small. The arsenic data are shown graphically in Figures D52, D53 and D54.

The maximum chromium concentration was 30 micrograms per liter. To provide a reference scale, the maximum contaminant level for chromium in drinking water is 50 micrograms per liter. Addition, chromium concentrations in excess of 10 to 15 micrograms per liter are considered to be detrimental to aquatic life. The maximum concentrations were 20, 30 and 10 micrograms per liter for the three seasonal periods. The average concentrations were 10, 11 and 4 micrograms per liter. These concentrations were well within the limit for treated water for water supplies. The data are shown graphically in Figures D55, D56 and D57.

The copper data are shown graphically in Figures D58, D59 and D60 for the three seasonal periods. The recommended limit is 1 mg/L for drinking water. The minimum, average and maximum copper concentrations were 3, 5.7 and 10 micrograms per liter in the May period. In the August period, the minimum, average and maximum concentrations were 2, 4.6 and 8 micrograms per liter. The minimum, average and maximum in the December period were 0, 5 and 7 micrograms per liter. For all of the data, the minimum, average and maximum concentrations were 0, 5.3 and 10 micrograms per liter. The copper concentrations were all within acceptable levels. All of the concentrations were well within acceptable levels for the protection of aquatic life.

The minimum, average and maximum iron concentrations for all of the data were 480, 1,700 and 5,000 micrograms per liter. The minimum, average and maximum concentrations for the May period were 650, 1,390 and 1,900 micrograms per liter. In the August period, the minimum, average and maximum concentrations were 480, 1,660 and 4,800 micrograms per liter. In the December period, the minimum, average and maximum concentrations were 1,200, 2,700 and 5,000 micrograms per liter. Thus, the seasonal average concentrations were 1,390, 1,660 and 2,700 micrograms per liter which indicated a significant seasonal variation. For reference purposes, the recommended maximum contaminant level for drinking water is 0.3 mg/L. Figures D61, D62 and D63 show the iron data plotted as a function of year. There were significant variations in the data by year. The general trend was in the May period was for relatively large concentrations of iron throughout the period of record. In the August period, the iron concentrations in the samples collected at 0.2 depth were less in recent years than the peak concentration in 1977. However, a peak concentration of

4,800 micrograms per liter occurred in the sample collected at 0.8 depth in 1980. Conversely, in the December period, the largest concentration, 5,000 micrograms per liter, occurred in a sample collected at 0.2 depth in 1980. The iron concentration in the sample collected at 0.8 depth in 1980 was 4,300 micrograms per liter. The iron concentrations in the most recent sample (1983) in the December period were 2,700 and 2,900 micrograms per liter for the 0.2 and 0.8 depths, respectively.

The maximum lead concentration in the record was 15 micrograms per liter. The maximum concentrations for the seasonal data were 15, 4 and 8 micrograms per liter in the May, August and December periods. The seasonal lead data are shown graphically in Figures D64, D65 and D66. As shown by these figures, there was considerable variation in the lead concentrations as a function of time in the May period. However, all of the lead concentrations were well below the new standard for drinking water.

Figures D67, C68 and C69 show the seasonal data for manganese. The minimum, average and maximum concentrations for all of the data were 30, 290 and 2,700 micrograms per liter. In the May period, the minimum, average and maximum concentrations were 50, 180 and 560 micrograms per liter. In the August period, the minimum, average and maximum concentrations were 90, 510 and 2,700 micrograms per liter. The minimum, average and maximum concentrations were 80, 220 and 450 micrograms per liter in the December period. Thus, the average seasonal concentrations were 180, 510 and 220 micrograms per liter. These averages indicated a significant variation in manganese concentration with the season of the year. The largest manganese concentrations usually occurred during the August period which would be expected. Except for one spike in 1980, the manganese concentrations were decreasing in the August period. They also generally decreased as a function of time in the December period. The recommended maximum contaminant level for drinking water is 0.05 mg/L.

Figures D70, D71 and D72 show the mercury data at the Highway 109 site. The maximum mercury concentration was 0.5 microgram per liter for all of the data. For the seasonal data, the maximum mercury concentrations were 0.1, 0.5 and 0.1 microgram per liter. These were relatively small mercury concentrations. The maximum contaminant level for mercury in drinking water is 2 micrograms per liter.

The nickel data are shown in Figures D73, D74 and D75 for the three seasonal periods. Overall, the maximum nickel concentration was 12 micrograms per liter. The maximum nickel concentrations were 12, 5, and 10 micrograms per liter in the May, August and December periods. All of the nickel concentrations well within acceptable levels for the protection of aquatic life.

The potassium concentrations were variable during each of the three seasonal periods. From 1979 until 1982 the potassium concentrations increased in the samples collected at 0.2 depth. They increase in the samples collected at 0.8 depth from 1980 until 1982. The maximum concentration was

5.2 mg/L which was considerably larger than in other Corps of Engineers lakes in western and southwestern Arkansas. However, potassium at this concentration was not particularly significant. The minimum, average and maximum concentrations were 0.6, 1.3 and 2.0 mg/L in the May period. In the August period, the average concentration was 2.4 mg/l with a range from 1.7 to 3.9 mg/L. The concentrations ranged from 1.5 to 3.4 mg/l in the December period with an average concentration of 2.5 mg/L. The data are shown graphically in Figures D76, D77 and D78.

The maximum zinc concentration for all of the data was 110 micrograms per liter. For the seasonal data, the maximum concentrations were 110, 20 and 40 micrograms per liter. These concentrations were usually well within acceptable levels for the protection of aquatic life. The data are shown graphically in Figures D79, D80 and D81. As shown in Figure D79, the zinc concentration increased significantly in the samples collected at both depths in 1982 in the May period. The data were relatively consistent at both depths in the August period.

Nitrogen. Figures D82, D83 and D84 show the un-ionized ammonia nitrogen concentrations at the Highway 109 site. The most recent sample was collected in 1984. In the May period, the minimum, average and maximum un-ionized ammonia nitrogen concentrations were 0.0000, 0.0001 and 0.0002 mg/L. They were 0.0001, 0.0003 and 0.0008 mg/L, respectively, for the August period. The range was from 0 to 0.0002 mg/L for the December period with an average concentration of 0.0001 mg/L. The peak concentration in the 1981 August period sample was unusually large. A second peak two years later raises the question of any trend which might have developed in subsequent years. The un-ionized ammonia concentrations in the May and December periods were usually small. All of the un-ionized ammonia nitrogen concentrations were less than the EPA criterion for the protection of aquatic life.

The ammonia data are shown graphically in Figures D85, D86 and D87. As shown in Figure D85, the ammonia nitrogen concentrations generally decreased in the samples collected at 0.2 depth during the May period from 1980 until 1984. In the August period, the ammonia nitrogen concentrations were highly variable with an unusually large concentration of 0.3 mg/L in 1977. The concentrations were smaller and more consistent in the December period. The average concentrations were 0.09, 0.12 and 0.08 mg/L, respectively, in the May, August and December periods. The maximum concentrations were 0.18, 0.32 and 0.12 mg/L for the three seasonal period.

The organic nitrogen data are shown in Figures D88, D89 and D90. As shown in Figure D88, the organic nitrogen concentrations decreased from 1980 until 1982 in the samples collected at both 0.2 and 0.8 depths. Except for the peak concentration of 2.3 mg/l in the sample collected at 0.8 depth in 1980, the organic nitrogen concentrations were relatively constant in the August period. As with the May and August periods, the peak organic nitrogen concentration occurred in the sample collected in 1980 with subsequent samples containing small concentrations of organic nitrogen.

The data are shown graphically in Figures D88, D89 and D90. The minimum, average and maximum concentrations were 0.26, 0.74 and 1.8 mg/L in the May period. The average concentration was 0.87 mg/L in the August period with a range from 0.50 to 2.3 mg/L. The minimum and maximum concentrations were 0.05 and 1.8 mg/L in the December period. The average concentration was 0.66 mg/L.

The nitrate nitrogen data are shown in Figures D91, D92 and D93 for the three seasonal periods. In the May period, the nitrate concentrations in the samples collected at both depths were usually the same. However, there were several exceptions to this tendency, particularly in the earlier and later years. The nitrate data tended to be relatively constant in the May period. In the August period, an unusually large nitrate concentration of 2.6 mg/L occurred in the sample collected at 0.2 depth in 1980. This concentration was about ten times as large as any other nitrate data in the August period. However, the nitrate concentrations have generally decreased in subsequent years. The nitrate concentrations in the samples collected in 1989 and 1990 in the August period were quite small. The general trend in the December period has been for decreasing nitrate concentrations as a function of time for the samples collected at 0.2 depth. The nitrate concentrations in samples collected at 0.8 depth have generally decreased in recent years. In recent years, the nitrate concentrations in the samples collected at 0.8 depth have been significantly larger than in the samples collected at 0.2 depth. The average nitrate concentration in the May period was 0.10 mg/L with the concentrations ranging from 0.01 to 0.20 mg/L. In the August period, the minimum, average and maximum concentrations were 0.01, 0.21 and 2.60 mg/L. In the December period, the minimum, average and maximum concentrations were 0.01, 0.24 and 0.55 mg/L. Thus, the average seasonal concentrations were 0.10, 0.21 and 0.24 mg/L which indicated some variation with respect to the season of the year.

The Total Kjeldahl Nitrogen data are shown graphically in Figures D94, D95 and D96. As shown by Figure D94, the Total Kjeldahl Nitrogen concentrations were decreasing from 1980 until 1983. The sample collected in 1984 may have reversed the trend, however. The most recent sample in the May period was collected in 1984. Generally, the Total Kjeldahl Nitrogen concentrations in the samples collected at 0.8 depth were larger than in the samples collected at 0.2 depth in the May period. As shown by Figure D95, a general, but not continuous, trend for decreasing Total Kjeldahl Nitrogen concentrations in the samples collected at 0.2 depth was apparent. The 2.3 mg/L concentration in the sample collected at 0.8 depth in 1980 was more than twice as large as any other concentration in the August period. It did parallel the peak concentration in the May period of 1980. The Total Kjeldahl Nitrogen data were variable in the December period with no clearly defined trends apparent. The average seasonal concentrations were 0.72, 0.89 and 0.81 mg/L in the May, August and December periods, respectively. The data ranged form 0.20 to 1.90 mg/L in the May period.

The minimum and maximum concentrations were 0.40 and 2.3 mg/L in the August period. The range in the December period was from 0.17 to 1.80 mg/L.

The total nitrogen data are shown in Figures D97, D98 and D99 for the three seasonal periods. As shown by Figure D97, the total nitrogen concentrations decreased from 1980 until 1982 in the May period. As shown by Figure D98, the data were scattered in the August period. A peak concentration of 3.4 mg/L occurred in 1980 for the samples collected at 0.2 depth. The average seasonal concentrations were 0.95, 1.40 and 1.0 in the May, August and December periods, respectively. The maximum concentrations were 1.9, 3.4 and 2.4 mg/L for the three seasonal periods.

pH. The pH for the three seasonal periods are shown in Figures D100, D101 and D102. As indicated by the figures, the pH values were near neutral and were all well within acceptable levels. The minimum, average and maximum pH values for all of the data were 5.8, 6.6 and 7.6 units. The average seasonal pH values were 6.5, 6.7 and 6.7 units in the May, August and December periods. The maximum pH values were 6.8, 7.5 and 7.4 units for the three seasonal periods. The minimum pH values were 5.8, 6.1 and 6.0 units. The trend has been for relatively constant pH values in the May and August seasonal periods. However, the pH values have been steadily increasing since 1985 in the samples collected at both the 0.2 and 0.8 depths in the December period.

Phosphorous. Figures D103, D104 and D105 show the seasonal total phosphorous data for the three seasonal periods. The minimum, average and maximum concentrations were 0.01, 0.06 and 0.18 mg/L for all of the data. In the May period, the minimum, average and maximum concentrations were 0.01, 0.05 and 0.10 mg/L. The minimum, average and maximum concentrations were 0.02, 0.06 and 0.14 mg/L, respectively, in the August period. The average concentration in the December period was 0.06 mg/L with the data ranging from 0.02 to 0.10 mg/L. The average seasonal total phosphorous concentrations were 0.05, 0.06 and 0.06 mg/L which indicated little variation in the average concentrations among the three seasons. However, the data were more scattered than the average concentrations would suggest. There were no clear tendencies either with respect to the total phosphorous concentrations as a function of time or as a function of depth. The December data were less scattered than the May and August data. The average total phosphorous concentrations were at or above the upper end of the range of concentrations usually encountered in large unpolluted lakes at this site.

The total phosphate data in the May period is shown in Figure D106. With only three concentrations reported for each depth, no conclusions regarding trends could be drawn.

The orthophosphate concentrations for the three seasonal periods are shown in Figures D107, D108 and D109. The maximum orthophosphate concentration for all of the data was 0.10 mg/L. For the seasonal data, the maximum concentrations were 0.07, 0.10 and 0.06 mg/L in the May, August and December periods. As shown by Figure D108, the orthophosphate concentrations for the samples collected at 0.2 depth peaked in 1977 and have been much smaller since. In the May period, the orthophosphate concentrations in the samples collected at 0.8 depth were usually smaller than in the samples collected at 0.2 depth. General patterns of increasing and decreasing orthophosphate concentrations characterize the May period data. The December period data are quite variable with no clear patterns evident. The orthophosphate concentrations were often larger than usual for unpolluted lakes at this site.

Sulfate. Figures D110, D111 and D112 show the sulfate data which were available at the Highway 109 sampling site. All of the sulfate concentrations were less than the standard for the Petit Jean River. The minimum, average and maximum sulfate concentrations for all of the data were 1.0, 8.2 and 15.0 mg/L. In the May period, the minimum, average and maximum concentrations were 2.0, 6.4 and 12.0 mg/L. The minimum, average and maximum concentrations were 1.0, 6.8 and 14.0 mg/L in the August period. The minimum, average and maximum concentrations were 7.0, 9.0 and 11.0 mg/L for the December period.

The sulfate concentrations decreased from 1978 until 1981 in the May period. However, they increased in 1982 and decreased again in 1983. In the August period, the sulfate concentrations increased from 1975 until 1979 and have been much smaller since 1979. The sulfate concentrations were relatively consistent in the December period.

Temperature. Figures D113, D114 and D115 show the seasonal data for the three seasonal periods. The maximum temperature was 30 degrees Celsius which was less than the standard of 32 degrees Celsius for lakes in the Arkansas River Valley Ecoregion. The average temperature was 17.6 degrees Celsius. The average seasonal temperature values were 19.4, 27.1 and 7.8 degrees Celsius. The maximum seasonal temperatures were 24.5, 30.0 and 11.0 degrees Celsius for the three seasonal periods.

Transparency. Figures D116, D117 and D118 show the transparency data for the three seasonal periods. The minimum, average and maximum transparencies were 4, 35 and 288 inches for all of the data. In the May period, the minimum, average and maximum transparencies were 4, 20 and 46 inches. The minimum, average and maximum values in the August period were 6, 26 and 46 inches. In the December period, the minimum, average and maximum transparencies were 12, 28 and 72 inches. The average transparency values were 20, 26 and 28 inches.

The transparency values varied considerably as a function of time, especially during the May period. All of the transparency values in the May period were less than the desirable forty-eight inches for primary contact recreation. There is no mandatory standard. However, the transparency value of forty-eight inches is recommended for safety reasons. The transparency data in the August period were more consistent than in the May period. However, all of the transparency values were less than forty-eight inches. A general trend for increasing transparency values was evident since 1984 in the December period. Surprisingly, the largest transparency value for any season occurred during the December period.

Turbidity. Figures D119, D120 and D122 show the turbidity data at the Highway 109 site. The specific standard for Blue Mountain Lake is 25 NTU for turbidity. Eleven of the twenty-six turbidity values in the May period equalled or exceeded the standard of 25 NTU. The largest turbidity values were 62 and 50 FTU which occurred in the samples collected at the 0.2 and 0.8 depths, respectively, in the May, 1986 period.

Five of the twenty turbidity values reported in the August period equalled or exceeded the turbidity standard for Blue Mountain Lake. The maximum turbidity value in the August period was 34 FTU. The maximum turbidity value for the December period was 300 FTU which was very large. This turbidity value occurred in the sample collected at 0.8 depth in 1980. The turbidity value in the sample collected at 0.2 depth was 150 FTU which was also relatively large. As shown by Figure D121, the turbidity values in the December period have generally been decreasing since the peak concentration in 1980. The minimum, average and maximum turbidities were 1.9, 26 and 300 FTU for all of the data. In the May period, the average turbidity value was 21 FTU with the range being from 1.9 to 62 FTU. In the August period, the minimum, average and maximum values were 1.9, 14 and 34 FTU. The minimum, average and maximum values were

3.1, 41 and 300 FTU, respectively, in the December period. The average seasonal turbidity concentrations were 21, 14 and 41 FTU. These were not small turbidity values.

Station Number 5 (Sugar Grove Site). The statistical analyses are summarized in Tables XXI, XXII and XXIII. The results of the graphical analyses are included in Figures E1 through E63 in Appendix E.

Alkalinity. The minimum and maximum total alkalinity concentrations were 2 and 30 mg/L. The overall average concentration was 11.4 mg/L. The average seasonal total alkalinity concentrations were 9.2, 15 and 10 mg/L. The minimum and maximum concentrations were 6 and 13 mg/L in the May season. The minimum and maximum concentrations were 8 and 20 mg/L in the August season. The minimum and maximum concentrations in the December season were 5 and 20 mg/L. The total alkalinity data are shown in Figures E1, E2 and E3. As shown by Figure E1, there was no apparent trend for the alkalinity concentrations as the data were variable. However, the alkalinity concentrations were small. The total alkalinity concentrations increased from 1979 until 1986 for the August period. The data were scattered in the December period with no apparent trend for either long-term increases or decreases in alkalinity.

Five-Day Biochemical Oxygen Demand. The minimum, average and maximum five-day biochemical oxygen demand concentrations were 0.2, 1.3 and 2.6 mg/L for all of the data. The average five-day biochemical oxygen demand concentration was 1.5 mg/L in the May period with the concentrations ranging from 0.9 to 2.6 mg/L. The minimum and maximum concentrations were 1.6 and 1.8 mg/L in the August period with an average concentration of 1.7 mg/L. In the December period, the range of concentrations was from 0.2 to 1.6 mg/L with the average concentration being 1.0 mg/L.

The data are shown graphically in Figures E4, E5 and E6. As shown by Figure E4, the five-day biochemical oxygen demand concentrations increased from 1984 until 1986. Following the peak concentration in 1986, the concentrations steadily decreased until the 1990 sample was collected. Only two five-day biochemical oxygen demand concentrations were reported in the August period. Consequently, no tendencies could be established. Some scatter was evident for the five-day biochemical oxygen demand data in the December period.

Although located in the same portion of the lake, the five-day biochemical oxygen demand data at the Sugar Grove site were more representative of that usually encountered in a large lake in Arkansas than the data at the Highway 109 site. The average seasonal concentrations were 1.5, 1.7 and 1.0 mg/L which indicated some variation in the average seasonal concentrations. However, these were relatively small changes in concentration.

Chloride. Only four chloride concentrations were reported at the Sugar Grove site. The minimum and maximum concentrations for all of the data were 1.0 and 4.0 mg/L. These chloride concentrations were very small compared with the recommended drinking water limit of 250 mg/L and were well within the specific standard of a maximum of 250 mg/L established for the Petit Jean River as established by Regulation Number 2 published by the Arkansas Department of Pollution Control and Ecology.

Chlorophyll a. Figures E7, E8 and E9 show the chlorophyll a data plotted as a function of time. The minimum, average and maximum chlorophyll a concentrations in all of the data were 0.1, 1.2 and 9.0 micrograms per liter. All of the chlorophyll a samples were collected at the three feet depth. In the May season, the minimum, average and maximum chlorophyll a concentrations were 0.1, 0.9 and 1.9 micrograms per liter. The average concentration in the August period was 3.9 micrograms per liter with the concentrations ranging from 1.0 to 9.0 micrograms per liter. In the December period, the range of concentrations was from 0.1 to 1.9 micrograms per liter with the average concentration being 0.5 micrograms per liter. The average seasonal concentrations were 0.9, 3.9 and 0.5 micrograms per liter which indicated substantial seasonal variation. The chlorophyll a concentrations noticeably increased from 1983 until 1988 for the May period. However, the chlorophyll a concentrations for the past two years have been small. In the December period, the chlorophyll a concentrations were larger from 1985 until 1988 than in prior and subsequent years. A peak chlorophyll a concentration of 9.0 micrograms per liter occurred in 1986 in the August period. However, this concentration was not unusually large for a large impounded water resource.

Chlorophyll b. The minimum, average and maximum chlorophyll b concentrations in the May period were 0.1, 0.1 and 0.4 micrograms per liter. In the August period, the data ranged from 0.1 to 0.5 micrograms per liter with an average concentration of 0.2 micrograms per liter. All of the chlorophyll b concentrations in the December period were 0.1 micrograms per liter. The samples which were analyzed for chlorophyll b were all collected at the three feet depth. The chlorophyll b data are shown in Figures E10, E11 and E12. As shown by Figures E10 and E11, peak chlorophyll b concentrations occurred for both seasonal periods in 1986. Except for the two peak concentrations, all of the chlorophyll b data were reported as 0.1 micrograms per liter.

Color. Figures E13, E14 and E15 show the color data for the three seasonal sampling periods. The maximum concentration was 130 units which was relatively large. With respect to the December seasonal data, a general, but not consistent, trend for decreasing color concentrations was apparent since 1980. The rule of thumb for color is that it should not exceed 50 units. Three of the ten color concentrations reported in the December period exceeded 50 units. A tendency for decreasing color concentrations was also apparent in the August period. In the August period, the maximum color concentration was 50 units. Thus, the concentrations did not exceed the recommended limit. The color data were more scattered in the May period. These data could be characterized as being reasonably small with occasional peaks in concentration. The maximum concentration was 100 units which was relatively large. Only on two occasions, however, did the color concentration exceed 50 units.

Conductivity. Figures E16, E17 and E18 show the data for the three seasonal periods. As shown by these figures, the conductivity values in the lake at the Sugar Grove site were relatively small. Overall, the maximum concentration was 64 micromhos per centimeter which indicated the presence of only moderate concentrations of ions. The minimum, average and maximum conductivity values were 28, 42 and 64 micromhos per centimeter for all data in the record. The minimum, average and maximum in the May period were 28, 36 and 48 micromhos per centimeter, respectively. The average conductivity in the August period was 52 micromhos per centimeter with the data ranging from 44 to 64 micromhos per centimeter. In the December period, the minimum, average and maximum conductivity values were 28, 38 and 53 micromhos per centimeter. Thus, the average concentrations were 36, 52 and 38 micromhos per centimeter indicating some seasonal variation. As indicated by the averages, the conductivity values in the August period were usually larger than in the May and December periods.

Although there is no water quality standard for conductivity as such, the parameter is related to total dissolved solids. The maximum allowable total dissolved solids concentration for the Petit Jean River is 500 mg/L.

Reservoir Depth. Figures E19, E20 and E21 show the depth of water in the reservoir at the Sugar Grove site for the three sets of seasonal data. As shown by Figures E19 and E21, the depths at the Sugar Grove sampling site varied considerably. They were usually about five feet or less. However, depths of twenty-eight feet have occurred in both the May and December periods.

Dissolved Oxygen. The seasonal data are shown in Figures E22, E23 and E24. The minimum, average and maximum concentrations for all data were 4.2, 8.8 and 12.7 mg/L. The average dissolved oxygen concentration during the May period was 7.8 mg/L with the concentrations ranging from 4.4 to 9.8 mg/L. In the August period, the minimum, average and maximum concentrations were 4.2, 5.7 and 6.3 mg/L. The minimum and maximum concentrations in the December period were 9.4 and 12.7 mg/L with the average concentration being 11.1 mg/L. The samples which were analyzed for dissolved oxygen were collected at mid-depth. As would be expected, the dissolved oxygen concentrations were larger during the December period than in the May and August periods and were larger in the May period than in the August period. A general trend for increasing dissolved oxygen concentrations was apparent in the December period. The dissolved oxygen concentrations were nearly constant in the August period. More variation in dissolved oxygen concentrations was apparent in the May period than in the August and December periods. The dissolved oxygen concentrations, expressed as percent of saturation, are shown in Figures E25, E26 and E27 for the three seasonal sampling periods.

Fecal Coliform. The minimum, average and maximum fecal coliform counts in the May period were 1, 538 and 6,000 colonies per 100 mL. In the August period, the average count was 83 colonies per 100 mL with the data ranging from 10 to 170 colonies per 100 mL. The minimum, average and maximum in the December period were 1, 272 and 1,600 colonies per 100 mL. The minimum, average and maximum counts for all data were 1, 318 and 6,000 colonies per 100 mL. The fecal coliform data are shown graphically in Figures E28, E29 and E30 for the three seasonal periods.

Blue Mountain Lake and the Petit Jean River are designated as primary contact waters. Consequently, the applicable standard based on Regulation No. 2 is a geometric mean of 200 colonies per 100 mL for the period between April 1 and September 30. Additionally, the fecal coliform count shall not exceed 400 colonies per 100 mL in more than 10 percent of the samples in any one month. The peak fecal coliform count occurred in August, 1986. This peak concentration was 6,000 colonies per 100 mL which indicated a water of poor quality with respect to this parameter. A secondary peak also occurred in 1984 during the May period. This concentration was 530 colonies per 100 mL. As shown by Figure E28, the fecal coliform counts since 1986 have been small and well within acceptable levels. However, the primary and secondary peak coliform counts suggest that continued monitoring for this parameter is very important. As shown by Figure E29, the coliform counts in the August period were less than the standard for primary contact recreation. However, the maximum coliform count was 1,600 colonies per 100 mL in the December period. This count occurred in 1984. Two secondary peaks of 430 and 470 colonies per 100 mL also occurred during the December period. These were in 1985 and 1980, respectively. Since 1986, the coliform counts have been small. In general, the fecal coliform counts decreased from 1981 until 1986 in the August period.

Hardness. The total hardness data for the three seasonal samples are shown in Figures E31, E32 and E33 at the Sugar Grove site. As shown by these figures, the total hardness concentrations in the samples collected were small. The maximum concentration was 32 mg/L which indicated the water was soft. The minimum, average and maximum total hardness concentrations for all of the data were 1, 13 and 32 mg/L (expressed as calcium carbonate). In the May period, the minimum, average and maximum concentrations were 7, 11 and 17 mg/L. The minimum, average and maximum concentrations in the August period were 1, 10 and 15 mg/L. The average concentration in the December period was 10 mg/L with the range being from 6 to 16 mg/L. A general trend for decreasing total hardness as a function of time was evident in the December period. The data for the May period was variable with a hint of decreasing concentrations as a function of time. The total hardness concentrations in the August period decreased as a function of time with the exception of the very small concentration reported in 1982.

The calcium data are shown in Figures E34, E35 and E36. The minimum, average and maximum calcium concentrations were 1, 5.2 and 14 mg/L, respectively, for all of the data. The average concentration in the May period was 4.5 mg/L with the range from 2 to 6 mg/L. In the August period, the calcium concentrations ranged from 1 to 8 mg/L with the average being 5.5 mg/L. The average concentration in the December period was 4.8 mg/L. The minimum and maximum calcium concentrations were 3 and 8 mg/L in the December period. The calcium data in the May period would have to be characterized as variable. A clear trend for decreasing calcium concentrations as a function of time was evident in the December period. Except for the 1982 sample, the calcium concentrations in the August period were nearly uniform.

The dissolved calcium data are shown in Figures E37, E38 and E39. The minimum, average and maximum dissolved calcium concentrations were 0.4, 1.8 and 3.1 mg/L for all of the data. In the May period, the minimum, average and maximum concentrations were 1.0, 1.8 and 2.6. In the August period, the minimum, average and maximum concentrations were 0.4, 2.1 and 2.9 mg/L. The minimum, average and maximum concentrations in the December period were 1.2, 1.9 and 3.1. Thus, the average seasonal concentrations were 1.8, 2.1 and 1.9 mg/L which indicated little average seasonal variation. The data in the December period generally decreased as a function of time until the sample collected in the December period in 1989. An overall, but inconsistent, trend for decreasing dissolved calcium concentrations was also evident in the May period.

The dissolved magnesium data are shown in Figures E40, E41 and E42. For all data, the minimum, average and maximum concentrations were 0.1, 1.4 and 2.2 mg/L. In the May period, the minimum, average and maximum concentrations were 0.9, 1.4 and 2.0 mg/L. Minimum, average and maximum concentrations of 0.1, 1.5 and 1.9 mg/L determined in the August period. In the December period, the minimum, average and maximum concentrations were 1.0, 1.4 and 2.2 mg/L. As indicated by these figures, there was very little magnesium in the water.

Nitrogen. Figures E43, E44 and E45 show the data for nitrate nitrogen at the Sugar Grove site for the three seasonal periods. The nitrate concentrations were generally small. The maximum nitrate nitrogen concentration for all of the data was 0.20 mg/L. For the seasonal data, the minimum, average and maximum concentrations were 0.02, 0.08 and 0.10 mg/L in the May period. In the August period, the minimum, average and maximum concentrations were 0.02, 0.06 and 0.10 mg/L. In the December period, the minimum, average and maximum concentrations were 0.02, 0.08 and 0.20 mg/L. Thus, the average seasonal concentrations were 0.08, 0.06 and 0.08 mg/L which indicated little seasonal variation. Except for the samples collected in 1988 and 1989, the nitrate nitrogen concentrations were constant in the May period. The concentrations in the samples collected in 1988 and 1989 were very small at 0.02 mg/L. A general trend for decreasing nitrate nitrogen concentrations as a function of time was evident in the December period.

pH. Figures E46, E47 and E48 show the pH values for the three seasonal periods. As shown by these figures, the pH values were all within the limits established by the Arkansas Department of Pollution and Control in Regulation No. 2. These limits are a minimum pH of 6 and a maximum pH of 9 units. The minimum, average and maximum pH values were 5.9, 6.6 and 7.5 units for all of the data. In the May period, the minimum, average and maximum pH values were 5.9, 6.4 and 6.9 units. The minimum, average and maximum pH values in the August period were 6.0, 6.5 and 7.0 units. The minimum, average and maximum pH values were 6.1, 6.7 and 7.5 units in the December period units. The average seasonal pH values were 6.4, 6.5 and 6.7 units which indicated little variation in the average values as a function of the season of the year. As shown by Figures E46, E47 and E48, there were small variations in pH values as a function of time. However, all of the pH values were near neutral.

Phosphorous. Figures E49, E50 and E51 show the total phosphorous data for the three seasonal periods. The minimum, average and maximum concentrations, respectively, were 0.01, 0.03 and 0.07 mg/L for all of the data. In the May period, the minimum, average and maximum concentrations were 0.01, 0.03 and 0.07 mg/L. In the August period, only two samples were reported. Both had total phosphorous concentrations of 0.02 mg/L. The average concentration was 0.03 mg/L in the December period with the data ranging from 0.02 to 0.05 mg/L. The average seasonal concentrations were 0.03, 0.02 and 0.03 mg/L which indicated very little variation. There was some variation as a function of time in the May and December seasonal periods. The total phosphorous concentrations tended to increase in the May period as a function of time. The total phosphorous concentrations were usually within the range usually encountered in large unpolluted lakes at this site.

The orthophosphate data for the three seasonal periods are shown in Figures E52, E53 and E54. The maximum orthophosphate concentration for all of the data was 0.03 mg/L. For the seasonal data, the maximum concentrations were 0.03, 0.01 and 0.02 mg/L in the May, August and December periods. The data in the May period can be characterized as usually being constant with occasion peak concentrations. Only two orthophosphate concentrations were reported in the August period. Both concentrations were 0.01 mg/L. The data in the December period were usually constant with occasional peak concentrations. The orthophosphate concentrations were about normal for large lakes at this site.

Temperature. Figures E55, E56 and E57 show the seasonal data for the three periods. The minimum, average and maximum temperatures were 3.0, 16.3 and 27.5 degrees Celsius for all of the data. The average seasonal temperature values were 19.3, 26.0 and 8.2 degrees Celsius in the May, August and December periods. The minimum temperatures were 15.5, 24.0 and 3.3 degrees Celsius. The maximum temperatures were 24.0, 27.5 and 11.0 for the three seasonal periods.

Transparency. Figures E58, E59 and E60 show the transparency data at the Sugar Grove site. The minimum, average and maximum transparency values were 4, 36 and 288 inches for all of the data. The maximum transparency values for the seasonal data were 48, 29 and 42 inches in the May, August and December periods. The minimum transparency values were 4, 9 and 12 inches in the May, August and December periods. The average transparency values were 31, 20 and 27 inches. Although these were relatively small transparency values, the transparency values were generally increasing with the passage of time in the August and December periods. The data in the May period would have to be characterized as being variable. For safety reasons, the rule of thumb is that a minimum transparency of forty-eight inches should exist for water used for primary contact recreation. Thus, all of the transparency values in the August period were less than the recommended minimum. Although all of the transparency values in the December period were less than the recommended minx, primary contact recreation does not ordinarily occur in the winter months. Two transparency values in the May period were forty-eight inches. All of the other transparency data were less than forty-eight inches. Consequently, the water at this sampling site could not be characterized as having good clarity.

Turbidity. Figures E61, E62 and E63 show the turbidity data at the Sugar Grove site. The minimum, average and maximum turbidity values were 2.0, 11.6 and 53 FTU for all of the data. The maximum turbidity values for the seasonal data were 53, 18 and 30 FTU in the May, August and December periods. The minimum turbidity values were 3.5, 3.5 and 2.0 FTU. The average turbidity values were 13.5, 6.9 and 13.1 FTU for the three seasonal periods. The turbidity values in the May period were variable, but usually relatively small, except for the peak concentration of 53 FTU in 1986. The peak concentration was the only turbidity value which exceeded the limit of 25 NTU for Blue Mountain Lake. The turbidity data in the August period were relatively small and usually constant. All of the turbidity values in the August period were less than the turbidity standard of 25 NTU for Blue Mountain Lake. All of the turbidity values in the December period were within the standard of 25 NTU, except the peak concentration of 30 FTU.

Station Number 6 (Narrows Site). The statistical analyses are summarized in Tables XXIV, XXV and XXVI. The results of the graphical analyses are included in Figures F1 through F66 in Appendix F.

Alkalinity. The minimum and maximum alkalinity concentrations were 7 and 55 mg/L. The overall average concentration was 23.7 mg/L. The average seasonal total alkalinity concentrations were 17.6, 32.0 and 22.2 mg/L. The minimum and maximum concentrations were 10 and 27 mg/L in the May season. The minimum and maximum concentrations were 12 and 55 mg/L in the August season. The minimum and maximum concentrations in the December season were 9 and 55 mg/L. As indicated by these data and by Figures F1, F2 and F3, the total alkalinity concentrations were generally larger during the August period than during the May and December periods. However, the alkalinity concentrations were all within acceptable levels at all times. Except for peak concentrations in 1979 and 1989, the December alkalinity data were nearly uniform. Considerable variation occurred in the alkalinity concentrations in the August seasonal period as a function of time. However, these variations do not indicate a consistent trend toward either increasing or decreasing concentrations. The data in the May period seemed to suggest the possibility of a trend for slightly increasing concentrations as a function of time. However, if present, this trend was for slowly increasing concentrations.

Five-Day Biochemical Oxygen Demand. The minimum, average and maximum five-day biochemical oxygen demand concentrations were 0.5, 2.4 and 5.9 mg/L for all of the data. In the May period, the average five-day biochemical oxygen demand concentration was 2.2 with the data ranging from 0.8 to 5.9 mg/L. The minimum and maximum concentrations were 1.9 and 3.5 in the August period with an average concentration of 2.6 mg/L. The minimum, average and maximum concentrations in the December period were 0.7, 2.3 and 5.8 mg/L. The data are shown graphically in Figures F4, E5 and F6. The five-day biochemical oxygen demand concentrations generally increased from 1982 until 1986 in the May period. They have generally been decreasing as a function of time since 1986. The five-day biochemical oxygen demand data in the August period were relatively uniform with no large peak concentrations. The trend in the August period was for the five-day biochemical oxygen demand concentrations to stay about the same. In the December period, the five-day biochemical oxygen demand concentrations decreased significantly from 1979 until 1981 and have remained relatively constant since. Thus, the December period data would be characterized as being relatively constant since 1981. The peak concentrations in May of 1986 and in December of 1979 and 1980 were unusually large for a lake in this area of Arkansas. The depth of water in the lake was not unusually large for any of these periods. Consequently, it probably does not indicate the five-day biochemical oxygen demand was washed into the reservoir.

Chloride. Only four chloride concentrations were reported for this site. The minimum, average and maximum concentrations for all of the data were 2.0, 3.5 and 6 mg/L.

Chlorophyll a. Figures F7, F8 and F9 show the chlorophyll a data plotted as a function of time. The minimum, average and maximum chlorophyll a concentrations for all of the data were 0.1, 6.6 and 27.0 micrograms per liter. All of the chlorophyll a samples were collected at the three foot depth. In the May season, the minimum, average and maximum chlorophyll a concentrations were 0.9, 7.2 and 22.0 micrograms per liter. The minimum and maximum concentrations in the August period were 0.1 and 27.0 micrograms per liter with the average concentration being 11.1 micrograms per liter. The range of chlorophyll a concentrations in the December period was from 0.1 to 11.0 micrograms per liter. The average concentration in the December period was 2.0 micrograms per liter. The average seasonal concentrations were 7.2, 11.1 and 2.0 micrograms per liter which indicated substantial seasonal variation. In the May period, the chlorophyll a concentrations peaked in 1987 and have been declining since. There was a general trend for increasing chlorophyll a concentrations prior to 1987. From 1983 until 1985 the chlorophyll a concentrations decreased during the August period. However, the chlorophyll a concentration in the sample collected in 1986 was much larger than in prior years. The peak concentration occurred the following year at a concentration of 27.0 micrograms per liter. The samples collected the past two years have had chlorophyll a concentrations less than the 1986 and 1987 samples, but larger than in the pre-1986 samples. In the December period, the chlorophyll a concentrations were nearly uniform, and small, until 1989. The December period of 1989 sample contained 11.0 micrograms per liter which was unusually large in the December period.

Chlorophyll b. The minimum, average and maximum chlorophyll b concentrations in the May period were 0.1, 0.8 and 3.3 micrograms per liter. In the August period, the minimum, average and maximum concentrations were 0.1, 1.7 and 3.2 micrograms per liter. The minimum, average and maximum in the December period were 0.1, 0.1 and 0.2 micrograms per liter. The minimum, average and maximum chlorophyll b concentrations for all data were 0.1, 0.8 and 3.3 micrograms per liter. The samples which were analyzed for chlorophyll b were all collected at the three feet depth. The chlorophyll b data are shown in Figures F10, F11 and F12. The chlorophyll b data peaked in 1987 in the May period and has been decreasing each year since. The chlorophyll b data in the August period has to be characterized as being variable with the general pattern paralleling that for chlorophyll a. In the December period, the chlorophyll b concentrations have been nearly uniform and small throughout the period of record.

Color. Figures F13, F14 and F15 show the color data for the three seasonal sampling periods. The maximum concentration was 180 units. With respect to the December seasonal data, the color concentrations have generally been decreasing since 1980. Similarly, the color concentrations have generally been decreasing since 1977 in the August period. The trend for decreasing color concentrations as a function of time were not consistent in the August period, but the long-term trend has been for decreasing color concentrations. The data in the May period have been variable with a general trend for decreasing color concentrations from 1980 until 1988. Since 1988, however, the color concentrations have been increasing.

The minimum, average and maximum color concentrations for all of the data were 3.0, 54 and 180 units. In the May period, the minimum, average and maximum concentrations were 5, 46 and 100 units. The minimum, average and maximum concentrations were 3, 50 and 160 units in the August period. The minimum, average and maximum concentrations in the December period were 10, 57 and 180 units.

The rule of thumb is that color should not exceed fifty units. Water with a color in excess of 50 units may limit photosynthesis and may have a deleterious effect upon aquatic life. The aquatic life particularly includes phytoplankton and the benthos. As indicated by Figures F13, F14 and F15, the color concentrations frequently exceeded 50 units. For example, five of the thirteen color concentrations in the record in the May period equalled or exceeded 50 units. Five of the twelve concentrations in the August period equalled or exceeded 50 units. Four of ten concentrations in the December period were 50 units or greater. Thus, on average, the color equals or exceeded the rule of thumb value of 50 units about forty percent of the time. However, there were periods when the color concentration was well within the recommended limit.

Conductivity. Figures F16, F17 and F18 show the conductivity data for the three seasonal periods. As shown by these figures, the conductivity values in the lake at the Narrows site were moderate. The minimum, average and maximum conductivity values were 38, 86 and 171 for all data in the record. The average conductivity value in the May period was 70 with the data ranging from 56 to 100 micromhos per centimeter. The minimum, average and maximum in the August period were 62, 100 and 171 micromhos per centimeter. In the December period, the minimum and maximum values were 38 and 156 micromhos per centimeter. The average value in the December period was 85 micromhos per centimeter. Thus, the average concentrations were 70, 100 and 85 micromhos per centimeter which indicated significant seasonal variations.

As shown by Figure F16, there were variations as a function of time in the conductivity values in the May period. However, the overall trend was for the conductivity values to remain about the same. More variation in the data was apparent in the August period, as shown in Figure F17, but there does not appear to be a long-term trend for either increasing or decreasing conductivity values. Except for the 1979 and 1989 conductivity values in the December period, the conductivity values were relatively constant. The December period conductivity values generally parallel the total alkalinity concentrations for this period.

Reservoir Depth. Figures F19, F20 and F21 show the depth of water in the reservoir at the Narrows site for the three sets of seasonal data. As shown by Figure F19, the lake was unusually full in 1979 and 1990 in the May period with the depth at this site being twenty-eight feet. The depth of water at the Narrows site was twenty feet in Dec 1984 which was larger than usual in the December period.

Dissolved Oxygen. The seasonal data are shown in Figures F22, F23 and F24. The minimum, average and maximum concentrations for all data were 0.1, 7.5 and 12.5 mg/L. The average dissolved oxygen concentrations were 7.8, 3.9 and 10.2 mg/L in the May, August and December periods, respectively. The minimum concentrations were 6.4, 0.1 and 4.2 mg/L for the three seasonal periods. The maximum concentrations were 8.8, 7.5 and 12.5 mg/L in the May, August and December seasonal periods, respectively. As shown by Figure F24, there was a general trend for increasing dissolved oxygen concentrations as a function of time in the December period. The dissolved oxygen concentrations for the May period were relatively constant with a tendency for slightly increasing dissolved oxygen concentrations as a function of time. The August period data were variable, but the dissolved oxygen concentrations were significantly smaller than in the May and December periods.

The dissolved oxygen concentrations, expressed as percent of saturation, are shown in Figures F25, F26 and F27 for the three seasonal periods.

Fecal Coliform. The minimum, average and maximum fecal coliform counts in the May period were 0, 890 and 9,000 colonies per 100 mL. In the August period, the minimum and maximum counts were 33 and 440 colonies per 100 mL with the average being 124 colonies per 100 mL. The minimum, average and maximum in the December period were 9, 261 and 1,300 colonies per 100 mL. The minimum, average and maximum counts for all data were 0, 458 and 9,000 colonies per 100 mL. The fecal coliform data are shown graphically in Figures F28, F29 and F30.

Blue Mountain Lake and the Petit Jean River are designated as primary contact waters. Consequently, the applicable standard based on Regulation No. 2 is a geometric mean of 200 colonies per 100 mL for the period between April 1 and September 30. Additionally, the fecal coliform count shall not exceed 400 colonies per 100 mL in more than 10 percent of the samples in any one month. The fecal coliform counts often exceeded 200 colonies per 100 mL during the May period. The peak fecal coliform concentration of 9,000 colonies per 100 mL was very large. Six of the thirteen fecal coliform counts reported in the May period were larger than

200 colonies per 100 mL. One of the remaining seven counts was 200 colonies per 100 mL. Consequently, the fecal coliform counts were of considerable concern in the May period. Fortunately, the general tendency has been for smaller fecal coliform counts during the past four years. In the August period, a general trend of increasing fecal coliform counts was apparent from 1977 until 1986. The 1990 fecal coliform count was much smaller than the 1986 value. In the December period, the fecal coliform counts generally increased from 1979 until 1985 and have usually been decreasing since. The peak concentration of 1,300 colonies per 100 mL occurred in 1985 and was sufficiently large to cause concern.

Hardness. The total hardness data in the May, August and December seasonal samples are shown in Figures F31, F32 and F33 at the Narrows site. As shown by these figures, the total hardness concentrations in the samples collected are usually small. The maximum concentration was 56 mg/L which indicated the water was soft. The minimum, average and maximum total hardness concentrations for all of the data were 1, 24 and 56 mg/L (expressed as calcium carbonate). In the May period, the minimum, average and maximum concentrations were 12, 19 and 24 mg/L. The minimum, average and maximum concentrations in the August period were 1, 26 and 51 mg/L. In the December period, the minimum, average and maximum concentrations were 8, 21 and 42 mg/L. A general trend for decreasing total hardness concentrations as a function of time was evident in the December period. The trend in the August period has been variable, but the total hardness concentrations have been smaller since 1981 than in prior years. In the May period, a consistent trend for decreasing concentrations as a function of time was evident from 1978 until 1981. However, the general trend has been for slightly increasing concentrations since 1981.

The calcium data are shown in Figures F34, F35 and F36. As shown by Figure F34, the calcium concentrations generally decreased from 1978 until 1983 in the May period. The data were variable in the August period with an increasing trend from 1977 until 1980. The calcium concentrations were smaller in 1981, 1982 and 1983 than in prior years. A trend for decreasing calcium concentrations was also apparent in the December period. The minimum, average and maximum calcium concentrations were 1, 12 and 28 mg/L for all of the data. The concentrations in the May period ranged from 6 to 12 mg/L with an average concentration of 8 mg/L. The average concentration in the August period was 12 mg/L with the range being from 1 to 28 mg/L. In the December period, the average concentration was 11 mg/L with the data ranging from 7 to 22 mg/L.

The dissolved calcium data are shown in Figures F37, F38 and F39. The trend in the December period was for the dissolved calcium data to parallel the trends for total alkalinity and conductivity. That is, the concentrations were nearly uniform with peak concentrations in 1979 and 1989. In the May period, the dissolved calcium decreased from 1978 until 1981 and have been variable since. Any long-term trend for either increasing or decreasing concentrations would be very slight. The data varied considerably during the August period, but a general trend for increasing dissolved calcium concentrations was apparent from 1982 until 1990. The minimum, average and maximum concentrations were 0.4, 4.4 and 11 mg/L for all of the data. The average concentration in the May period was 3.4 mg/L with the data ranging from 2.3 to 4.8 mg/L. The minimum and maximum concentrations were 0.4 and 11 mg/L in the August period with the average concentration being 4.9 mg/L. The minimum, average and maximum concentrations in the December period were 2.7, 4.7 and 8.7 mg/L, respectively.

The dissolved magnesium data are shown in Figures F40, F41 and F42. As indicated by Figure F42, the dissolved magnesium data parallel the dissolved calcium, total alkalinity and conductivity with respect to relatively uniform concentrations most of the time with peak concentrations in 1979 and 1989. The data in the May and August periods were variable. However, the dissolved magnesium concentrations have been steadily decreasing since 1987 in the May period. They have generally been increasing since 1982 in the August period. As indicated by these figures, there was very little magnesium in the water. The minimum, average and maximum concentrations for all of the data were 0.1, 2.9 and 5.8 mg/L. The data ranged from 1.4 to 3.5 mg/L in the May period with an average concentration of 2.4 mg/L. The minimum and maximum concentrations were 0.1 and 5.7 mg/L for the August period. In the August period, the average concentration was 3.4 mg/L. The minimum, average and maximum dissolved magnesium concentrations in the December period were 2.1, 3.3 and 4.8 mg/L.

Limited noncarbonate hardness data were available at this site. The data are shown in Figures F43, F44 and F45. The minimum, average and maximum concentrations for all of the data were 0, 6.3 and 21 mg/L. The average concentrations were 4, 10.5 and 2.5 mg/L in the May, August and December periods, respectively. The maximum concentrations were 7, 21 and 5 mg/L for the three seasonal periods.

Nitrogen. Figures F46, F47 and F48 show the data for nitrate nitrogen at the Narrows site for the three seasonal periods. The maximum nitrate nitrogen concentration for all of the data was 0.50 mg/L. For the seasonal data, the minimum, average and maximum concentrations were 0.02, 0.15 and 0.30 mg/L in the May period. In the August period, the minimum, average and maximum concentrations were 0.02, 0.09 and 0.20 mg/L. In the December period, the minimum, average and maximum concentrations were 0.02, 0.23 and 0.50 mg/L. Thus, the average seasonal concentrations were 0.15, 0.09 and 0.23 mg/L which indicated some seasonal variation. The data in the December period indicated a trend for decreasing nitrate concentrations as a function of time since 1985. In the August period, the nitrate nitrogen concentrations peaked in 1986 and have generally been declining since. The nitrate concentrations have been smaller since 1987 in the May period than in prior years.

pH. Figures F49, F50 and F51 show the pH values for the three seasonal periods. As shown by these figures, the pH values were all within the limits established by the Arkansas Department of Pollution and Control in Regulation No. 2. The minimum, average and maximum pH values were 6.0, 6.8 and 8.3 units for all of the data. In the May period, the minimum, average and maximum pH values were 6.1, 6.6 and 7.1 units. The minimum, average and maximum pH values in the August period were 6.4, 6.9 and 8.3 units. The minimum, average and maximum pH values were 6.1, 6.8 and 7.6 units in the December period. The average seasonal pH values were 6.6, 6.9 and 6.8 units which indicated some variation in the average values as a function of the season of the year. As shown by the figures, there were only slight variations in pH values as a function of the time. There has been a trend for slightly increasing pH values in the December period since 1985. This was preceded by a slightly decreasing trend from 1981 until 1985 in the December period.

Phosphorous. Figures F52, F53 and F54 show the total phosphorous data for the three seasonal periods. The minimum, average and maximum concentrations, respectively, were 0.01, 0.12 and 1.10 mg/L for all of the data. In the May period, the minimum and maximum concentrations were 0.05 and 0.20 mg/L. The average concentration in the May period was 0.08 mg/L. The average concentration was 0.21 in the August period with the data ranging from 0.02 to 1.1 mg/L. The minimum, average and maximum concentrations were 0.01, 0.06 and 0.09 mg/L in the December period. The average seasonal concentrations were 0.08, 0.21 and 0.06 mg/L which indicated an apparent variation in the seasonal averages. However, there was an unusually large total phosphorous concentration in the 1980 sample for the August period. Actually, the total phosphorous concentrations have been constant since 1986 in the August period. Except for the 1980 sample in the August period, the trends have been for relatively small and constant total phosphorous concentrations for all three seasonal periods. The total phosphorous concentrations were usually larger than normal for large unpolluted lakes at this site.

The orthophosphate concentrations for the three periods are shown in Figures F55, F56 and F57. The maximum orthophosphate concentration for all of the data was 0.11 mg/L. For the seasonal data, the maximum concentrations were 0.11, 0.04 and 0.06 mg/L in the May, August and December periods. The average orthophosphate concentrations were 0.04, 0.02 and 0.04 mg/L for the three seasonal periods. As shown by the figures, the orthophosphate concentrations varied as a function of time for all three seasons. The variation was larger in the May period than in the August and December periods. The orthophosphate concentrations were relatively large at this site.

Temperature. Figures F58, F59 and F60 show the seasonal data. The minimum, average and maximum temperatures were 3.0, 17.8 and 30.0 degrees Celsius for all of the data. The average seasonal temperature values were 20.1, 26.9 and 7.4 degrees Celsius in the May, August and December periods. The minimum temperatures were 16.5, 23.5 and 3.3 degrees

Celsius for the three seasonal periods. The maximum temperatures were 25.0, 30.0 and 10.5 degrees Celsius.

Transparency. Figures F61, F62 and F63 show the transparency data at the Narrows site. The minimum, average and maximum transparency values were 2, 21 and 216 inches for all of the data. The maximum transparency for the seasonal data were 30, 24 and 48 inches in the May, August and December periods. The minimum transparency values were 2, 6 and 5 inches in the May, August and December periods. The average transparency values were 15, 15 and 19 inches. The transparency values have generally been increasing since 1985 in the December period. They have also generally been increasing since 1981 in the August period. The May period data would have to be characterized as variable with no apparent long-term trends.

It is important to realize that only one transparency value equalled the recommended minimum of forty-eight inches for primary contact recreation. All of the other transparency values were less.

Turbidity. Figures F64, F65 and F66 show the turbidity data at the Narrows site. The minimum, average and maximum turbidity values were 2.0, 29 and 130 FTU for all of the data. The maximum turbidity values for the seasonal data were 120, 56 and 130 FTU in the May, August and December periods. The minimum turbidity values were 2.8, 2.0 and 2.3 FTU for the three seasonal periods. The average turbidity values were 32, 18 and 27 FTU. In the December period, the turbidity concentrations have generally been decreasing since 1980. They were relatively constant in the May period until 1986. The turbidity values have been smaller since 1987 during the May period than in prior years. The August period data would have to be characterized as variable.

The turbidity values in the May period frequently exceed the standard for 25 NTU for Blue Mountain Lake. Seven of the twelve values reported for this site were larger than the limit of 25 FTU. In the August period, four of the eleven values reported were larger than 25 FTU. Two of the ten values reported in the December period were larger than 25 FTU.

Table IX. Water Quality Data for the Petit Site: Period of Record and Spring Season.

STATION 1	PERIOD OF RECORD				SPRING SEASON			
PETIT	N	MEAN	MIN	MAX	N	MEAN	MIN	MAX
Temperature, Celsius	143	16.3700	1.0000	29.0000	24	19.7900	13.5000	24.0000
Flow, CFS	6	55.1700	18.0000	90.0000	1	90.0000	90.0000	90.0000
Turbidity, FTU	42	24.9200	5.3000	99.0000	13	28.1500	7.0000	58.0000
Color, Units	39	112.3800	5.0000	1500.0000	12	59.2500	8.0000	100.0000
Conductivity, Micromhos/cm	113	64.2100	35.0000	93.0000	20	57.0000	50.0000	73.0000
Dissolved Oxygen, mg/L	108	10.1500	4.8000	52.0000	20	10.3600	6.4000	45.0000
Dissolved Oxygen, % Saturation	107	92.2700	59.3000	113.0000	19	92.3100	72.7000	103.8000
Biochemical Oxygen Demand, mg/L	40	1.8300	0.2000	3.8000	11	2.2500	1.1000	3.8000
pH, Standard Units	109	6.9400	6.0000	8.6000	20	6.6500	6.2000	7.3000
Carbon Dioxide, mg/L	6	5.5200	1.9000	17.0000	2	10.2000	3.4000	17.0000
Total Alkalinity, mg/L (as CaCO3)	34	38.0300	5.0000	750.0000	10	13.3000	10.0000	19.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	8	19.3800	6.0000	33.0000	3	17.6700	15.0000	21.0000
Carbonate Alkalinity, mg/L (as CO3)	8	0.0000	0.0000	0.0000	3	0.0000	0.0000	0.0000
Total Nitrogen, mg/L (as N)	21	0.8100	0.3200	1.7000	4	0.6700	0.3200	0.9400
Organic Nitrogen, mg/L (as N)	22	0.6000	0.2400	1.3000	5	0.6400	0.2400	1.3000
Ammonia Nitrogen, mg/L (as N)	27	0.0900	0.0000	0.3300	7	0.1200	0.0400	0.2800
Un-ionized Ammonia Nitrogen, mg/L (as N)	20	0.0003	0.0000	0.0020	7	0.0002	0.0001	0.0007
Total Kjeldahl Nitrogen, mg/L (as N)	27	0.6600	0.1000	1.5000	7	0.6300	0.2000	1.4000
Nitrate Nitrogen, mg/L (as N)	39	0.1500	0.0000	0.4900	11	0.1100	0.0200	0.2300
Total Phosphate, mg/L (as PO4)	8	0.1000	0.0300	0.2800	3	0.1600	0.0900	0.2800
Total Phosphorous, mg/L (as P)	39	0.0800	0.0200	0.4000	11	0.0700	0.0200	0.2100
Total Hardness, mg/L (as CaCO3)	33	19.9700	8.0000	38.0000	9	17.1100	8.0000	31.0000
Noncarbonate Hardness, mg/L (asCaCO3)	13	5.3100	0.0000	14.0000	4	6.5000	2.0000	14.0000
Calcium, mg/l (as CaCO3)	25	11.0000	6.0000	32.0000	6	9.6700	6.0000	20.0000
Dissolved Calcium, mg/L (as Ca)	25	3.9900	2.2000	8.2000	9	3.5800	2.2000	8.2000
Dissolved Magnesium, mg/L (as Mg)	25	2.3000	1.5000	3.4000	9	2.0800	1.5000	2.6000
Potassium, mg/L	22	1.8100	1.0000	3.1000	5	1.4400	1.0000	1.8000
Chloride, mg/L	29	3.7900	0.0000	7.0000	8	3.0000	0.0000	6.0000
Sulfate, mg/L	28	8.6400	1.0000	15.0000	7	8.5700	6.0000	12.0000
Arsenic, ug/L	22	1.9100	0.0000	8.0000	5	1.0000	1.0000	1.0000
Chromium, ug/L	12	8.3300	0.0000	30.0000	4	7.5000	0.0000	20.0000
Copper, ug/L	16	5.3800	0.0000	20.0000	5	5.8000	3.0000	10.0000
Iron, ug/L	26	2260.0000	400.0000	16000.0000	6	980.0000	580.0000	1500.0000
Lead, ug/L	16	7.9400	0.0000	57.0000	5	5.6000	1.0000	12.0000
Manganese, ug/L	26	409.2300	60.0000	1700.0000	6	171.6700	60.0000	330.0000
Nickel, ug/L	15	4.3300	1.0000	10.0000	5	4.2000	3.0000	7.0000
Zinc, ug/L	17	19.7100	0.0000	50.0000	5	11.0000	0.0000	20.0000
Aluminum, ug/L	22	978.1800	20.0000	5800.0000	5	328.0000	20.0000	570.0000

Table X. Water Quality Data for the Petit Site: Period of Record and Summer Season.

STATION 1	PERIOD OF RECORD				SUMMER SEASON			
PETIT	N	MEAN	MIN	MAX	N	MEAN	MIN	MAX
Temperature, Celsius	143	16.3700	1.0000	29.0000	25	26.1000	21.0000	29.0000
Flow, CFS	6	55.1700	18.0000	90.0000	1	78.0000	78.0000	78.0000
Turbidity, FTU	42	24.9200	5.3000	99.0000	8	18.8800	11.0000	31.0000
Color, Units	39	112.3800	5.0000	1500.0000	9	197.7800	20.0000	1500.0000
Conductivity, Micromhos/cm	113	64.2100	35.0000	93.0000	18	70.0600	58.0000	86.0000
Dissolved Oxygen, mg/L	108	10.1500	4.8000	52.0000	18	6.6000	4.8000	8.2000
Dissolved Oxygen, % Saturation	107	92.2700	59.3000	113.0000	18	80.7400	59.3000	97.6000
Biochemical Oxygen Demand, mg/L	40	1.8300	0.2000	3.8000	12	1.7100	0.2000	3.1000
pH, Standard Units	109	6.9400	6.0000	8.6000	18	6.9800	6.2000	8.6000
Carbon Dioxide, mg/L	6	5.5200	1.9000	17.0000	1	4.4000	4.4000	4.4000
Total Alkalinity, mg/L (as CaCO3)	34	38.0300	5.0000	750.0000	8	112.1300	17.0000	750.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	8	19.3800	6.0000	33.0000	1	22.0000	22.0000	22.0000
Carbonate Alkalinity, mg/L (as CO3)	8	0.0000	0.0000	0.0000	1	0.0000	0.0000	0.0000
Total Nitrogen, mg/L (as N)	21	0.8100	0.3200	1.7000	6	0.9200	0.5100	1.7000
Organic Nitrogen, mg/L (as N)	22	0.6000	0.2400	1.3000	6	0.6500	0.3600	1.0000
Ammonia Nitrogen, mg/L (as N)	27	0.0900	0.0000	0.3300	7	0.1300	0.0000	0.3300
Un-ionized Ammonia Nitrogen, mg/L (as N)	20	0.0003	0.0000	0.0020	5	0.0006	0.0000	0.0020
Total Kjeldahl Nitrogen, mg/L (as N)	27	0.6600	0.1000	1.5000	7	0.7400	0.4000	1.2000
Nitrate Nitrogen, mg/L (as N)	39	0.1500	0.0000	0.4900	11	0.1400	0.0200	0.4900
Total Phosphate, mg/L (as PO4)	8	0.1000	0.0300	0.2800	3	0.0700	0.0300	0.1500
Total Phosphorous, mg/L (as P)	39	0.0800	0.0200	0.4000	11	0.0900	0.0200	0.4000
Total Hardness, mg/L (as CaCO3)	33	19.9700	8.0000	38.0000	8	22.1300	15.0000	38.0000
Noncarbonate Hardness, mg/L (asCaCO3)	13	5.3100	0.0000	14.0000	2	9.0000	6.0000	12.0000
Calcium, mg/l (as CaCO3)	25	11.0000	6.0000	32.0000	6	12.6700	8.0000	20.0000
Dissolved Calcium, mg/L (as Ca)	25	3.9900	2.2000	8.2000	6	5.0300	3.2000	8.2000
Dissolved Magnesium, mg/L (as Mg)	25	2.3000	1.5000	3.4000	6	2.4500	1.7000	3.1000
Potassium, mg/L	22	1.8100	1.0000	3.1000	6	2.1000	1.5000	3.1000
Chloride, mg/L	29	3.7900	0.0000	7.0000	7	3.8600	2.0000	5.0000
Sulfate, mg/L	28	8.6400	1.0000	15.0000	7	6.8600	1.0000	9.0000
Arsenic, ug/L	22	1.9100	0.0000	8.0000	6	2.8300	1.0000	8.0000
Chromium, ug/L	12	8.3300	0.0000	30.0000	4	12.5000	0.0000	30.0000
Copper, ug/L	16	5.3800	0.0000	20.0000	5	6.6000	2.0000	20.0000
Iron, ug/L	26	2260.0000	400.0000	16000.0000	7	3458.5700	830.0000	16000.0000
Lead, ug/L	16	7.9400	0.0000	57.0000	4	3.0000	1.0000	4.0000
Manganese, ug/L	26	409.2300	60.0000	1700.0000	7	1060.0000	460.0000	1700.0000
Nickel, ug/L	15	4.3300	1.0000	10.0000	4	2.5000	1.0000	3.0000
Zinc, ug/L	17	19.7100	0.0000	50.0000	5	20.0000	0.0000	40.0000
Aluminum, ug/L	22	978.1800	20.0000	5800.0000	6	908.3300	260.0000	3200.0000

Table XI. Water Quality Data for the Petit Site: Period of Record and Winter Season.

STATION 1 PETIT	PERIOD OF RECORD				WINTER SEASON			
	N	MEAN	MIN	MAX	N	MEAN	MIN	MAX
Temperature, Celsius	143	16.3700	1.0000	29.0000	24	8.1300	1.0000	15.0000
Flow, CFS	6	55.1700	18.0000	90.0000				
Turbidity, FTU	42	24.9200	5.3000	99.0000	8	15.9100	5.3000	42.0000
Color, Units	39	112.3800	5.0000	1500.0000	8	45.6300	5.0000	120.0000
Conductivity, Micromhos/cm	113	64.2100	35.0000	93.0000	18	61.1100	35.0000	91.0000
Dissolved Oxygen, mg/L	108	10.1500	4.8000	52.0000	18	11.7600	9.7000	15.0000
Dissolved Oxygen, % Saturation	107	92.2700	59.3000	113.0000	18	98.8200	89.8000	111.7000
Biochemical Oxygen Demand, mg/L	40	1.8300	0.2000	3.8000	8	1.5500	0.8000	2.4000
pH, Standard Units	109	6.9400	6.0000	8.6000	18	7.0400	6.3000	7.6000
Carbon Dioxide, mg/L	6	5.5200	1.9000	17.0000				
Total Alkalinity, mg/L (as CaCO3)	34	38.0300	5.0000	750.0000	6	17.1700	12.0000	20.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	8	19.3800	6.0000	33.0000				
Carbonate Alkalinity, mg/L (as CO3)	8	0.0000	0.0000	0.0000				
Total Nitrogen, mg/L (as N)	21	0.8100	0.3200	1.7000	3	0.6700	0.6000	0.7300
Organic Nitrogen, mg/L (as N)	22	0.6000	0.2400	1.3000	3	0.5200	0.3000	0.6700
Ammonia Nitrogen, mg/L (as N)	27	0.0900	0.0000	0.3300	4	0.0700	0.0200	0.1200
Un-ionized Ammonia Nitrogen, mg/L (as N)	20	0.0003	0.0000	0.0020	4	0.0001	0.0000	0.0002
Total Kjeldahl Nitrogen, mg/L (as N)	27	0.6600	0.1000	1.5000	4	0.8100	0.3700	1.5000
Nitrate Nitrogen, mg/L (as N)	39	0.1500	0.0000	0.4900	8	0.1200	0.0000	0.2300
Total Phosphate, mg/L (as PO4)	8	0.1000	0.0300	0.2800	2	0.0300	0.0300	0.0300
Total Phosphorous, mg/L (as P)	39	0.0800	0.0200	0.4000	8	0.0400	0.0300	0.0600
Total Hardness, mg/L (as CaCO3)	33	19.9700	8.0000	38.0000	6	16.6700	12.0000	20.0000
Noncarbonate Hardness, mg/L (asCaCO3)	13	5.3100	0.0000	14.0000	2	1.0000	1.0000	1.0000
Calcium, mg/l (as CaCO3)	25	11.0000	6.0000	32.0000	4	8.2500	6.0000	10.0000
Dissolved Calcium, mg/L (as Ca)	25	3.9900	2.2000	8.2000	5	3.4400	2.6000	4.1000
Dissolved Magnesium, mg/L (as Mg)	25	2.3000	1.5000	3.4000	5	2.3200	2.0000	2.6000
Potassium, mg/L	22	1.8100	1.0000	3.1000	3	1.5700	1.3000	1.8000
Chloride, mg/L	29	3.7900	0.0000	7.0000	4	4.2500	3.0000	6.0000
Sulfate, mg/L	28	8.6400	1.0000	15.0000	4	7.7500	5.0000	9.0000
Arsenic, ug/L	22	1.9100	0.0000	8.0000	3	0.3300	0.0000	1.0000
Chromium, ug/L	12	8.3300	0.0000	30.0000	3	0.0000	0.0000	0.0000
Copper, ug/L	16	5.3800	0.0000	20.0000	3	3.3300	0.0000	5.0000
Iron, ug/L	26	2260.0000	400.0000	16000.0000	4	712.5000	400.0000	1400.0000
Lead, ug/L	16	7.9400	0.0000	57.0000	3	19.6700	0.0000	57.0000
Manganese, ug/L	26	409.2300	60.0000	1700.0000	4	147.5000	100.0000	200.0000
Nickel, ug/L	15	4.3300	1.0000	10.0000	3	4.0000	2.0000	6.0000
Zinc, ug/L	17	19.7100	0.0000	50.0000	3	23.3300	10.0000	40.0000
Aluminum, ug/L	22	978.1800	20.0000	5800.0000	3	213.3300	110.0000	350.0000

Table XII. Water Quality Data for the Waveland Site: Period of Record and Spring Season.

STATION 2 WAVELAND	PERIOD OF RECORD				SPRING SEASON			
	N	MEAN	MIN	MAX	N	MEAN	MIN	MAX
Temperature, Celsius	626	17.2700	0.5000	32.5000	150	20.2400	13.5000	30.5000
Turbidity, FTU	98	24.6800	3.5000	300.0000	30	25.8500	6.6000	82.0000
Transparency, Inches	119	24.0500	1.0000	216.0000	23	22.1700	8.0000	50.0000
Color, Units	84	93.5100	2.0000	1600.0000	28	67.2500	30.0000	120.0000
Conductivity, Micromhos/cm	636	62.4300	34.0000	101.0000	150	55.5700	37.0000	73.0000
Dissolved Oxygen, mg/L	627	7.5200	0.0000	14.2000	150	6.5500	0.4000	10.0000
Dissolved Oxygen, % Saturation	626	73.0300	0.0000	113.8000	150	71.3300	3.9000	113.8000
Biochemical Oxygen Demand, mg/L	87	1.5400	0.0000	2.9000	26	1.5800	0.6000	2.6000
pH, Standard Units	628	6.8600	2.2600	8.3000	150	6.7200	5.9300	7.9700
Carbon Dioxide, mg/L	12	5.3800	0.7000	16.0000	4	10.9300	6.4000	16.0000
Total Alkalinity, mg/L (as CaCO3)	72	15.8100	5.0000	28.0000	21	12.9000	10.0000	16.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	13	19.1500	6.0000	33.0000	4	17.2500	13.0000	20.0000
Carbonate Alkalinity, mg/L (as CO3)	13	0.0000	0.0000	0.0000	4	0.0000	0.0000	0.0000
Total Nitrogen, mg/L (as N)	43	0.8400	0.3800	2.6000	8	0.6800	0.3800	1.0000
Organic Nitrogen, mg/L (as N)	45	0.5800	0.0300	2.2000	10	0.4600	0.2800	0.6800
Ammonia Nitrogen, mg/L (as N)	54	0.1000	0.0100	0.4000	15	0.1200	0.0100	0.3000
Un-ionized Ammonia Nitrogen, mg/L (as N)	40	0.0003	0.0000	0.0020	14	0.0002	0.0000	0.0006
Total Kjeldahl Nitrogen, mg/L (as N)	54	0.6400	0.2000	2.3000	15	0.5200	0.3000	0.8700
Nitrate Nitrogen, mg/L (as N)	104	0.1300	0.0000	0.4900	33	0.0800	0.0100	0.2400
Total Phosphate, mg/L (as PO4)	14	0.0800	0.0000	0.2800	6	0.1500	0.0900	0.2800
Total Phosphorous, mg/L (as P)	114	0.0800	0.0100	1.6000	36	0.0500	0.0100	0.1100
Total Hardness, mg/L (as CaCO3)	64	18.7700	12.0000	40.0000	18	16.2200	12.0000	23.0000
Noncarbonate Hardness, mg/L (asCaCO3)	25	3.8000	0.0000	12.0000	8	3.3800	0.0000	7.0000
Calcium, mg/l (as CaCO3)	49	9.5500	5.0000	20.0000	12	8.8300	6.0000	13.0000
Dissolved Calcium, mg/L (as Ca)	57	3.5000	2.1000	6.4000	22	3.2000	2.4000	5.1000
Dissolved Magnesium, mg/L (as Mg)	57	2.2100	1.3000	3.5000	22	1.8800	1.3000	2.5000
Potassium, mg/L	43	1.8000	0.6000	3.2000	10	1.4200	0.6000	2.0000
Chloride, mg/L	52	4.0600	1.0000	9.0000	12	3.2500	2.0000	5.0000
Sulfate, mg/L	52	8.6700	2.0000	16.0000	12	7.5800	2.0000	12.0000
Arsenic, ug/L	43	1.7700	0.0000	8.0000	10	1.2000	1.0000	2.0000
Chromium, ug/L	32	8.9400	0.0000	40.0000	10	9.0000	0.0000	20.0000
Copper, ug/L	30	4.6700	0.0000	12.0000	10	5.4000	3.0000	12.0000
Iron, ug/L	51	2448.8240	120.0000	33000.0000	12	1078.3300	550.0000	1900.0000
Lead, ug/L	30	5.3700	1.0000	33.0000	10	6.6000	2.0000	15.0000
Manganese, ug/L	51	487.4500	40.0000	4900.0000	12	284.1700	40.0000	1700.0000
Nickel, ug/L	30	4.7300	2.0000	16.0000	10	5.8000	3.0000	16.0000
Zinc, ug/L	34	24.8500	0.0000	100.0000	10	25.5000	0.0000	80.0000
Aluminum, ug/L	41	877.0700	20.0000	4700.0000	9	352.2200	20.0000	730.0000
Fecal Coliform (Colonies/100 ml)	5	5.4000	2.0000	12.0000				
Fecal Coliform (Colonies/100 ml)	41	13.3900	0.0000	140.0000	13	7.4600	0.0000	30.0000
Calcium Hardness, mg/L (as CaCO3)	57	17.7400	11.0000	27.0000	22	15.6400	11.0000	23.0000
Orthophosphate, mg/L (as P)	114	0.0400	0.0000	1.6000	36	0.0300	0.0100	0.0900
Chlorophyll A, ug/L	37	8.1700	0.3000	30.0000	11	7.0500	0.5000	17.0000
Chlorophyll B, ug/L	37	0.6300	0.1000	4.0000	11	0.4100	0.1000	0.9000
Ammonia Nitrogen, mg/L (as NH4)	12	0.0900	0.0100	0.3000	4	0.1600	0.0500	0.3000
Total Phosphorous, mg/L (as PO4)	51	0.1700	0.0300	1.3000	18	0.1400	0.0900	0.2800
Total Nitrogen, mg/L (as NO3)	43	3.7500	1.7000	12.0000	8	3.0100	1.7000	4.6000
Mercury, ug/L	43	0.2500	0.0000	2.7000	10	0.0900	0.0000	0.3000
Depth of Reservoir, Feet	676	34.0000	5.0000	65.0000	158	37.3300	25.0000	65.0000

Table XIII. Water Quality Data for the Waveland Site: Period of Record and Summer Season.

STATION 2 WAVELAND	PERIOD OF RECORD N	MEAN	MIN	MAX	SUMMER SEASON N	MEAN	MIN	MAX
Temperature, Celsius	626	17.2700	0.5000	32.5000	102	26.4700	22.5000	32.5000
Turbidity, FTU	98	24.6800	3.5000	300.0000	19	16.2900	4.5000	32.0000
Transparency, Inches	119	24.0500	1.0000	216.0000	21	20.5200	2.0000	42.0000
Color, Units	84	93.5100	2.0000	1600.0000	19	119.9500	2.0000	1600.0000
Conductivity, Micromhos/cm	636	62.4300	34.0000	101.0000	102	70.8100	52.0000	94.0000
Dissolved Oxygen, mg/L	627	7.5200	0.0000	14.2000	102	4.1900	0.0000	7.6000
Dissolved Oxygen, % Saturation	626	73.0300	0.0000	113.8000	102	51.5000	0.0000	97.0000
Biochemical Oxygen Demand, mg/L	87	1.5400	0.0000	2.9000	23	1.5200	0.0000	2.9000
pH, Standard Units	628	6.8600	2.2600	8.3000	102	6.7600	5.8000	7.8000
Carbon Dioxide, mg/L	12	5.3800	0.7000	16.0000	2	2.0000	1.2000	2.8000
Total Alkalinity, mg/L (as CaCO3)	72	15.8100	5.0000	28.0000	17	19.9400	10.0000	28.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	13	19.1500	6.0000	33.0000	2	17.0000	12.0000	22.0000
Carbonate Alkalinity, mg/L (as CO3)	13	0.0000	0.0000	0.0000	2	0.0000	0.0000	0.0000
Total Nitrogen, mg/L (as N)	43	0.8400	0.3800	2.6000	11	0.9300	0.4000	1.8000
Organic Nitrogen, mg/L (as N)	45	0.5800	0.0300	2.2000	11	0.7000	0.2600	1.1000
Ammonia Nitrogen, mg/L (as N)	54	0.1000	0.0100	0.4000	13	0.1300	0.0100	0.4000
Un-ionized Ammonia Nitrogen, mg/L (as N)	40	0.0003	0.0000	0.0020	10	0.0007	0.0001	0.0020
Total Kjeldahl Nitrogen, mg/L (as N)	54	0.6400	0.2000	2.3000	13	0.7800	0.3000	1.3000
Nitrate Nitrogen, mg/L (as N)	104	0.1300	0.0000	0.4900	25	0.1200	0.0000	0.4900
Total Phosphate, mg/L (as PO4)	14	0.0800	0.0000	0.2800	4	0.0200	0.0000	0.0600
Total Phosphorous, mg/L (as P)	114	0.0800	0.0100	1.6000	29	0.1100	0.0200	1.6000
Total Hardness, mg/L (as CaCO3)	64	18.7700	12.0000	40.0000	15	19.6700	12.0000	40.0000
Noncarbonate Hardness, mg/L (asCaCO3)	25	3.8000	0.0000	12.0000	4	4.7500	0.0000	9.0000
Calcium, mg/l (as CaCO3)	49	9.5500	5.0000	20.0000	11	10.3600	6.0000	14.0000
Dissolved Calcium, mg/L (as Ca)	57	3.5000	2.1000	6.4000	12	3.9700	2.2000	5.6000
Dissolved Magnesium, mg/L (as Mg)	57	2.2100	1.3000	3.5000	12	2.5300	1.9000	3.0000
Potassium, mg/L	43	1.8000	0.6000	3.2000	11	2.0600	1.5000	3.2000
Chloride, mg/L	52	4.0600	1.0000	9.0000	13	3.5400	2.0000	5.0000
Sulfate, mg/L	52	8.6700	2.0000	16.0000	13	7.2300	5.0000	10.0000
Arsenic, ug/L	43	1.7700	0.0000	8.0000	11	2.3600	1.0000	8.0000
Chromium, ug/L	32	8.9400	0.0000	40.0000	10	8.6000	0.0000	40.0000
Copper, ug/L	30	4.6700	0.0000	12.0000	8	3.7500	2.0000	5.0000
Iron, ug/L	51	2448.8240	120.0000	33000.0000	13	3696.9230	120.0000	33000.0000
Lead, ug/L	30	5.3700	1.0000	33.0000	8	2.3800	1.0000	4.0000
Manganese, ug/L	51	487.4500	40.0000	4900.0000	13	1246.1500	240.0000	4900.0000
Nickel, ug/L	30	4.7300	2.0000	16.0000	8	3.2500	2.0000	5.0000
Zinc, ug/L	34	24.8500	0.0000	100.0000	10	25.0000	0.0000	100.0000
Aluminum, ug/L	41	877.0700	20.0000	4700.0000	10	482.0000	180.0000	1300.0000
Fecal Coliform (Colonies/100 ml)	5	5.4000	2.0000	12.0000	2	10.0000	8.0000	12.0000
Fecal Coliform (Colonies/100 ml)	41	13.3900	0.0000	140.0000	12	4.9200	0.0000	33.0000
Calcium Hardness, mg/L (as CaCO3)	57	17.7400	11.0000	27.0000	12	20.1700	13.0000	24.0000
Orthophosphate, mg/L (as P)	114	0.0400	0.0000	1.6000	29	0.0700	0.0000	1.6000
Chlorophyll A, ug/L	37	8.1700	0.3000	30.0000	12	10.5400	1.9000	28.0000
Chlorophyll B, ug/L	37	0.6300	0.1000	4.0000	12	0.6600	0.1000	4.0000
Ammonia Nitrogen, mg/L (as NH4)	12	0.0900	0.0100	0.3000	4	0.0600	0.0100	0.2000
Total Phosphorous, mg/L (as PO4)	51	0.1700	0.0300	1.3000	16	0.1700	0.0600	0.4900
Total Nitrogen, mg/L (as NO3)	43	3.7500	1.7000	12.0000	11	4.1400	1.8000	7.9000
Mercury, ug/L	43	0.2500	0.0000	2.7000	11	0.1800	0.0000	0.5000
Depth of Reservoir, Feet	676	34.0000	5.0000	65.0000	113	27.8000	5.0000	40.0000

Table XIV. Water Quality Data for the Waveland Site: Period of Record and Winter Season.

STATION 2 WAVELAND	PERIOD OF RECORD N	MEAN	MIN	MAX	WINTER SEASON N	MEAN	MIN	MAX
Temperature, Celsius	626	17.2700	0.5000	32.5000	106	8.5100	0.5000	15.0000
Turbidity, FTU	98	24.6800	3.5000	300.0000	20	16.0100	3.8000	42.0000
Transparency, Inches	119	24.0500	1.0000	216.0000	20	23.7000	11.0000	50.0000
Color, Units	84	93.5100	2.0000	1600.0000	18	44.1100	5.0000	120.0000
Conductivity, Micromhos/cm	636	62.4300	34.0000	101.0000	106	57.4100	35.0000	90.0000
Dissolved Oxygen, mg/L	627	7.5200	0.0000	14.2000	106	10.6900	5.7000	14.2000
Dissolved Oxygen, % Saturation	626	73.0300	0.0000	113.8000	106	89.7400	47.9000	106.9000
Biochemical Oxygen Demand, mg/L	87	1.5400	0.0000	2.9000	20	1.3800	0.6000	2.2000
pH, Standard Units	628	6.8600	2.2600	8.3000	106	6.9900	6.2000	7.7000
Carbon Dioxide, mg/L	12	5.3800	0.7000	16.0000				
Total Alkalinity, mg/L (as CaCO3)	72	15.8100	5.0000	28.0000	16	15.6900	8.0000	20.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	13	19.1500	6.0000	33.0000				
Carbonate Alkalinity, mg/L (as CO3)	13	0.0000	0.0000	0.0000				
Total Nitrogen, mg/L (as N)	43	0.8400	0.3800	2.6000	6	0.7800	0.5600	1.0000
Organic Nitrogen, mg/L (as N)	45	0.5800	0.0300	2.2000	6	0.6300	0.2300	0.9800
Ammonia Nitrogen, mg/L (as N)	54	0.1000	0.0100	0.4000	8	0.0900	0.0200	0.3400
Un-ionized Ammonia Nitrogen, mg/L (as N)	40	0.0003	0.0000	0.0020	8	0.0002	0.0000	0.0005
Total Kjeldahl Nitrogen, mg/L (as N)	54	0.6400	0.2000	2.3000	8	0.6300	0.2000	1.0000
Nitrate Nitrogen, mg/L (as N)	104	0.1300	0.0000	0.4900	24	0.1200	0.0000	0.2400
Total Phosphate, mg/L (as PO4)	14	0.0800	0.0000	0.2800	4	0.0200	0.0000	0.0300
Total Phosphorous, mg/L (as P)	114	0.0800	0.0100	1.6000	24	0.0400	0.0100	0.0600
Total Hardness, mg/L (as CaCO3)	64	18.7700	12.0000	40.0000	12	16.2500	12.0000	19.0000
Noncarbonate Hardness, mg/L (asCaCO3)	25	3.8000	0.0000	12.0000	4	2.2500	0.0000	7.0000
Calcium, mg/l (as CaCO3)	49	9.5500	5.0000	20.0000	8	8.0000	6.0000	9.0000
Dissolved Calcium, mg/L (as Ca)	57	3.5000	2.1000	6.4000	14	3.2000	2.3000	3.8000
Dissolved Magnesium, mg/L (as Mg)	57	2.2100	1.3000	3.5000	14	2.2600	1.7000	2.7000
Potassium, mg/L	43	1.8000	0.6000	3.2000	6	1.6800	1.5000	2.1000
Chloride, mg/L	52	4.0600	1.0000	9.0000	8	4.0000	3.0000	5.0000
Sulfate, mg/L	52	8.6700	2.0000	16.0000	8	8.1300	5.0000	10.0000
Arsenic, ug/L	43	1.7700	0.0000	8.0000	6	0.3300	0.0000	1.0000
Chromium, ug/L	32	8.9400	0.0000	40.0000	6	5.0000	0.0000	20.0000
Copper, ug/L	30	4.6700	0.0000	12.0000	6	4.1700	0.0000	8.0000
Iron, ug/L	51	2448.8240	120.0000	33000.0000	8	753.7500	250.0000	1600.0000
Lead, ug/L	30	5.3700	1.0000	33.0000	6	2.6700	2.0000	4.0000
Manganese, ug/L	51	487.4500	40.0000	4900.0000	8	138.7500	100.0000	230.0000
Nickel, ug/L	30	4.7300	2.0000	16.0000	6	3.5000	2.0000	5.0000
Zinc, ug/L	34	24.8500	0.0000	100.0000	6	28.3300	10.0000	50.0000
Aluminum, ug/L	41	877.0700	20.0000	4700.0000	6	228.3300	80.0000	380.0000
Fecal Coliform (Colonies/100 ml)	5	5.4000	2.0000	12.0000				
Fecal Coliform (Colonies/100 ml)	41	13.3900	0.0000	140.0000	10	28.0000	1.0000	140.0000
Calcium Hardness, mg/L (as CaCO3)	57	17.7400	11.0000	27.0000	14	17.2100	13.0000	20.0000
Orthophosphate, mg/L (as P)	114	0.0400	0.0000	1.6000	24	0.0200	0.0000	0.0500
Chlorophyll A, ug/L	37	8.1700	0.3000	30.0000	7	3.6100	0.3000	6.9000
Chlorophyll B, ug/L	37	0.6300	0.1000	4.0000	7	0.2700	0.1000	0.8000
Ammonia Nitrogen, mg/L (as NH4)	12	0.0900	0.0100	0.3000	4	0.0300	0.0200	0.0500
Total Phosphorous, mg/L (as PO4)	51	0.1700	0.0300	1.3000	11	0.1300	0.0300	0.1800
Total Nitrogen, mg/L (as NO3)	43	3.7500	1.7000	12.0000	6	3.4500	2.5000	4.4000
Mercury, ug/L	43	0.2500	0.0000	2.7000	6	0.0300	0.0000	0.1000
Depth of Reservoir, Feet	676	34.0000	5.0000	65.0000	110	37.1300	15.0000	65.0000

Table XV. Water Quality Data for the Ashley Creek Site: Period of Record and Spring Season.

STATION 3 ASHLEY CREEK	PERIOD OF RECORD N	MEAN	MIN	MAX	SPRING SEASON N	MEAN	MIN	MAX
Temperature, Celsius	45	19.3000	2.3000	33.5000	14	21.8600	17.0000	26.5000
Turbidity, FTU	38	21.6000	0.0000	100.0000	14	18.7900	0.0000	38.0000
Transparency, Inches	42	23.1400	6.0000	144.0000	12	18.2500	7.0000	49.0000
Color, Units	44	65.1600	0.0000	300.0000	14	57.1400	0.0000	100.0000
Conductivity, Micromhos/cm	45	73.0000	39.0000	130.0000	14	60.5700	50.0000	78.0000
Dissolved Oxygen, mg/L	45	8.8200	2.8000	13.7000	14	8.1500	2.8000	10.8000
Dissolved Oxygen, % Saturation	45	91.6200	31.1000	120.0000	14	91.9100	31.1000	120.0000
Biochemical Oxygen Demand, mg/L	20	2.0400	0.6000	3.4000	8	2.0800	1.3000	2.7000
pH, Standard Units	45	6.9900	6.0500	8.2000	14	6.7700	6.0500	7.3000
Carbon Dioxide, mg/L	2	2.5000	1.8000	3.2000	1	1.8000	1.8000	1.8000
Total Alkalinity, mg/L (as CaCO3)	38	16.7600	6.0000	46.0000	12	13.0000	9.0000	18.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	2	19.0000	16.0000	22.0000	1	22.0000	22.0000	22.0000
Ammonia Nitrogen, mg/L (as N)	1	0.1000	0.1000	0.1000	1	0.1000	0.1000	0.1000
Un-ionized Ammonia Nitrogen, mg/L (as N)	1	0.0002	0.0002	0.0002	1	0.0002	0.0002	0.0002
Total Kjeldahl Nitrogen, mg/L (as N)	1	0.4000	0.4000	0.4000	1	0.4000	0.4000	0.4000
Nitrate Nitrogen, mg/L (as N)	19	0.1100	0.0200	0.2800	7	0.0800	0.0200	0.1000
Total Phosphorous, mg/L (as P)	19	0.0600	0.0100	0.2000	7	0.0700	0.0100	0.2000
Total Hardness, mg/L (as CaCO3)	30	20.6700	12.0000	38.0000	8	17.2500	13.0000	22.0000
Noncarbonate Hardness, mg/L (asCaCO3)	10	7.8000	2.0000	14.0000	3	5.0000	4.0000	6.0000
Calcium, mg/l (as CaCO3)	24	10.3300	6.0000	24.0000	6	9.0000	6.0000	13.0000
Dissolved Calcium, mg/L (as Ca)	29	3.5400	0.0000	5.9000	11	3.0200	0.0000	5.1000
Dissolved Magnesium, mg/L (as Mg)	29	2.5900	0.0000	5.3000	11	1.8200	0.0000	2.5000
Chloride, mg/L	5	2.6000	0.0000	7.0000	2	1.5000	0.0000	3.0000
Fecal Coliform (Colonies/100 ml)	3	6.6700	0.0000	13.0000				
Fecal Coliform (Colonies/100 ml)	37	103.0500	0.0000	1100.0000	13	110.0000	0.0000	700.0000
Calcium Hardness, mg/L (as CaCO3)	29	19.5500	0.0000	35.0000	11	15.0900	0.0000	22.0000
Orthophosphate, mg/L (as P)	19	0.0200	0.0100	0.0500	7	0.0200	0.0100	0.0500
Chlorophyll A, ug/L	23	7.2300	0.2000	41.0000	8	6.6900	0.5000	19.0000
Chlorophyll B, ug/L	23	0.4800	0.1000	2.0000	8	0.4300	0.1000	1.2000
Total Phosphorous, mg/L (as PO4)	3	0.1700	0.1500	0.1800	1	0.1500	0.1500	0.1500
Depth of Reservoir, Feet	101	7.7800	2.0000	34.0000	30	10.0700	4.0000	30.0000

Table XVI. Water Quality Data for the Ashley Creek Site: Period of Record and Summer Season.

STATION 3	PERIOD OF RECORD				SUMMER SEASON			
ASHLEY CREEK	N	MEAN	MIN	MAX	N	MEAN	MIN	MAX
Temperature, Celsius	45	19.3000	2.3000	33.5000	12	30.0000	25.5000	33.5000
Turbidity, FTU	38	21.6000	0.0000	100.0000	11	16.1600	5.7000	29.0000
Transparency, Inches	42	23.1400	6.0000	144.0000	11	11.0000	6.0000	20.0000
Color, Units	44	65.1600	0.0000	300.0000	12	33.6700	4.0000	120.0000
Conductivity, Micromhos/cm	45	73.0000	39.0000	130.0000	12	73.4200	61.0000	120.0000
Dissolved Oxygen, mg/L	45	8.8200	2.8000	13.7000	12	7.0600	4.4000	8.8000
Dissolved Oxygen, % Saturation	45	91.6200	31.1000	120.0000	12	91.8600	57.9000	114.9000
Biochemical Oxygen Demand, mg/L	20	2.0400	0.6000	3.4000	6	2.4300	1.5000	3.4000
pH, Standard Units	45	6.9900	6.0500	8.2000	12	7.2200	6.2000	8.2000
Carbon Dioxide, mg/L	2	2.5000	1.8000	3.2000				
Total Alkalinity, mg/L (as CaCO3)	38	16.7600	6.0000	46.0000	10	20.9000	14.0000	46.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	2	19.0000	16.0000	22.0000				
Ammonia Nitrogen, mg/L (as N)	1	0.1000	0.1000	0.1000				
Un-ionized Ammonia Nitrogen, mg/L (as N)	1	0.0002	0.0002	0.0002				
Total Kjeldahl Nitrogen, mg/L (as N)	1	0.4000	0.4000	0.4000				
Nitrate Nitrogen, mg/L (as N)	19	0.1100	0.0200	0.2800	6	0.0700	0.0200	0.1000
Total Phosphorous, mg/L (as P)	19	0.0600	0.0100	0.2000	6	0.0600	0.0300	0.0700
Total Hardness, mg/L (as CaCO3)	30	20.6700	12.0000	38.0000	8	20.1300	12.0000	38.0000
Noncarbonate Hardness, mg/L (asCaCO3)	10	7.8000	2.0000	14.0000	2	4.5000	2.0000	7.0000
Calcium, mg/l (as CaCO3)	24	10.3300	6.0000	24.0000	6	10.8300	8.0000	20.0000
Dissolved Calcium, mg/L (as Ca)	29	3.5400	0.0000	5.9000	8	3.4000	1.2000	5.0000
Dissolved Magnesium, mg/L (as Mg)	29	2.5900	0.0000	5.3000	8	2.3400	2.0000	2.8000
Chloride, mg/L	5	2.6000	0.0000	7.0000	1	2.0000	2.0000	2.0000
Fecal Coliform (Colonies/100 ml)	3	6.6700	0.0000	13.0000	1	0.0000	0.0000	0.0000
Fecal Coliform (Colonies/100 ml)	37	103.0500	0.0000	1100.0000	8	14.3800	5.0000	57.0000
Calcium Hardness, mg/L (as CaCO3)	29	19.5500	0.0000	35.0000	8	18.1300	12.0000	24.0000
Orthophosphate, mg/L (as P)	19	0.0200	0.0100	0.0500	6	0.0200	0.0100	0.0300
Chlorophyll A, ug/L	23	7.2300	0.2000	41.0000	7	13.6900	1.7000	41.0000
Chlorophyll B, ug/L	23	0.4800	0.1000	2.0000	7	0.7400	0.1000	2.0000
Total Phosphorous, mg/L (as PO4)	3	0.1700	0.1500	0.1800	1	0.1800	0.1800	0.1800
Depth of Reservoir, Feet	101	7.7800	2.0000	34.0000	25	4.3200	2.0000	8.0000

Table XVII. Water Quality Data for the Ashley Creek Site: Period of Record and Winter Season.

STATION 3 ASHLEY CREEK	PERIOD OF RECORD N	MEAN	MIN	MAX	WINTER SEASON N	MEAN	MIN	MAX
Temperature, Celsius	45	19.3000	2.3000	33.5000	10	7.9600	2.3000	12.5000
Turbidity, FTU	38	21.6000	0.0000	100.0000	10	18.9800	4.4000	40.0000
Transparency, Inches	42	23.1400	6.0000	144.0000	10	23.9000	6.0000	72.0000
Color, Units	44	65.1600	0.0000	300.0000	10	51.2000	5.0000	120.0000
Conductivity, Micromhos/cm	45	73.0000	39.0000	130.0000	10	81.1000	39.0000	130.0000
Dissolved Oxygen, mg/L	45	8.8200	2.8000	13.7000	10	11.1200	8.0000	13.7000
Dissolved Oxygen, % Saturation	45	91.6200	31.1000	120.0000	10	92.3700	69.0000	103.8000
Biochemical Oxygen Demand, mg/L	20	2.0400	0.6000	3.4000	6	1.5800	0.6000	2.7000
pH, Standard Units	45	6.9900	6.0500	8.2000	10	7.0800	6.8000	7.7000
Carbon Dioxide, mg/L	2	2.5000	1.8000	3.2000				
Total Alkalinity, mg/L (as CaCO3)	38	16.7600	6.0000	46.0000	8	17.6300	11.0000	26.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	2	19.0000	16.0000	22.0000				
Ammonia Nitrogen, mg/L (as N)	1	0.1000	0.1000	0.1000				
Un-Ionized Ammonia Nitrogen, mg/L (as N)	1	0.0002	0.0002	0.0002				
Total Kjeldahl Nitrogen, mg/L (as N)	1	0.4000	0.4000	0.4000				
Nitrate Nitrogen, mg/L (as N)	19	0.1100	0.0200	0.2800	6	0.1700	0.0200	0.2800
Total Phosphorous, mg/L (as P)	19	0.0600	0.0100	0.2000	6	0.0500	0.0200	0.0700
Total Hardness, mg/L (as CaCO3)	30	20.6700	12.0000	38.0000	6	20.8300	12.0000	31.0000
Noncarbonate Hardness, mg/L (asCaCO3)	10	7.8000	2.0000	14.0000	2	8.5000	3.0000	14.0000
Calcium, mg/l (as CaCO3)	24	10.3300	6.0000	24.0000	4	9.2500	8.0000	10.0000
Dissolved Calcium, mg/L (as Ca)	29	3.5400	0.0000	5.9000	7	4.0900	3.1000	5.9000
Dissolved Magnesium, mg/L (as Mg)	29	2.5900	0.0000	5.3000	7	3.7700	2.4000	5.3000
Chloride, mg/L	5	2.6000	0.0000	7.0000	1	7.0000	7.0000	7.0000
Fecal Coliform (Colonies/100 ml)	3	6.6700	0.0000	13.0000				
Fecal Coliform (Colonies/100 ml)	37	103.0500	0.0000	1100.0000	10	161.1000	0.0000	1100.0000
Calcium Hardness, mg/L (as CaCO3)	29	19.5500	0.0000	35.0000	7	25.7100	18.0000	35.0000
Orthophosphate, mg/L (as P)	19	0.0200	0.0100	0.0500	6	0.0200	0.0100	0.0300
Chlorophyll A, ug/L	23	7.2300	0.2000	41.0000	7	2.2600	0.2000	10.0000
Chlorophyll B, ug/L	23	0.4800	0.1000	2.0000	7	0.3300	0.1000	1.5000
Total Phosphorous, mg/L (as PO4)	3	0.1700	0.1500	0.1800	1	0.1800	0.1800	0.1800
Depth of Reservoir, Feet	101	7.7800	2.0000	34.0000	23	10.4300	2.0000	34.0000

Table XVIII. Water Quality Data for the Hwy109 Site: Period of Record and Spring Season.

STATION 4 HWY109	PERIOD OF RECORD N	MEAN	MIN	MAX	SPRING SEASON N	MEAN	MIN	MAX
Temperature, Celsius	83	17.6500	3.0000	30.0000	26	19.4400	15.5000	24.5000
Turbidity, FTU	72	26.4500	1.9000	300.0000	26	21.2400	2.5000	62.0000
Transparency, Inches	42	35.4800	4.0000	288.0000	12	19.6700	4.0000	46.0000
Color, Units	81	49.0100	5.0000	230.0000	25	44.6400	5.0000	100.0000
Conductivity, Micromhos/cm	91	79.1300	32.0000	165.0000	26	60.2300	32.0000	97.0000
Dissolved Oxygen, mg/L	83	6.8900	0.1000	13.1000	26	6.5700	0.1000	9.1000
Dissolved Oxygen, % Saturation	83	67.6800	1.1000	113.9000	26	70.5500	1.1000	107.1000
Biochemical Oxygen Demand, mg/L	86	2.2800	0.2000	7.8000	26	1.9800	0.4000	6.6000
pH, Standard Units	83	6.6400	5.8000	7.6000	26	6.4600	5.8000	6.8100
Carbon Dioxide, mg/L	12	12.2900	1.0000	33.0000	4	14.9000	6.6000	25.0000
Total Alkalinity, mg/L (as CaCO3)	72	21.6400	2.0000	54.0000	22	15.8200	8.0000	25.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	12	21.2500	3.0000	39.0000	4	21.7500	13.0000	29.0000
Carbonate Alkalinity, mg/L (as CO3)	12	0.0000	0.0000	0.0000	4	0.0000	0.0000	0.0000
Total Nitrogen, mg/L (as N)	39	0.9600	0.1900	3.4000	9	0.9500	0.3900	1.9000
Organic Nitrogen, mg/L (as N)	41	0.6900	0.0500	2.3000	10	0.7400	0.2600	1.8000
Ammonia Nitrogen, mg/L (as N)	50	0.0800	0.0100	0.3200	14	0.0900	0.0100	0.1800
Un-ionized Ammonia Nitrogen, mg/L (as N)	37	0.0001	0.0000	0.0008	14	0.0001	0.0000	0.0002
Total Kjeldahl Nitrogen, mg/L (as N)	50	0.7200	0.1000	2.3000	14	0.7200	0.2000	1.9000
Nitrate Nitrogen, mg/L (as N)	85	0.1700	0.0100	2.6000	26	0.1000	0.0100	0.2000
Total Phosphate, mg/L (as PO4)	15	0.0800	0.0000	0.2100	6	0.1400	0.0900	0.2100
Total Phosphorous, mg/L (as P)	85	0.0600	0.0100	0.1800	26	0.0500	0.0100	0.1000
Total Hardness, mg/L (as CaCO3)	57	23.2500	10.0000	110.0000	16	16.4400	10.0000	28.0000
Noncarbonate Hardness, mg/L (asCaCO3)	20	4.5500	0.0000	14.0000	6	2.6700	0.0000	8.0000
Calcium, mg/l (as CaCO3)	45	11.8900	4.0000	75.0000	12	8.0000	4.0000	14.0000
Dissolved Calcium, mg/L (as Ca)	54	4.4500	1.8000	30.0000	20	3.3500	1.8000	5.7000
Dissolved Magnesium, mg/L (as Mg)	54	2.7100	1.2000	7.8000	20	2.1100	1.2000	3.4000
Potassium, mg/L	41	2.0500	0.6000	5.2000	10	1.3300	0.6000	2.0000
Chloride, mg/L	48	4.4600	0.0000	9.0000	12	2.5800	0.0000	5.0000
Sulfate, mg/L	48	8.2300	1.0000	15.0000	12	6.4200	2.0000	12.0000
Arsenic, ug/L	41	1.1700	0.0000	2.0000	10	1.2000	0.0000	2.0000
Chromium, ug/L	24	10.1300	0.0000	30.0000	8	10.0000	0.0000	20.0000
Copper, ug/L	28	5.2900	0.0000	10.0000	10	5.7000	3.0000	10.0000
Iron, ug/L	48	1697.7100	480.0000	5000.0000	12	1392.5000	650.0000	1900.0000
Lead, ug/L	28	5.3600	0.0000	15.0000	10	6.7000	1.0000	15.0000
Manganese, ug/L	48	290.4200	30.0000	2700.0000	12	182.5000	50.0000	560.0000
Nickel, ug/L	28	5.0700	2.0000	12.0000	10	4.9000	3.0000	12.0000
Zinc, ug/L	30	28.3300	10.0000	110.0000	10	35.0000	10.0000	110.0000
Aluminum, ug/L	39	501.0300	20.0000	3800.0000	8	321.2500	20.0000	710.0000
Fecal Coliform (Colonies/100 ml)	5	22.8000	2.0000	80.0000				
Fecal Coliform (Colonies/100 ml)	40	532.2800	0.0000	7500.0000	13	780.6200	1.0000	7500.0000
Calcium Hardness, mg/L (as CaCO3)	54	22.3100	10.0000	107.0000	20	17.0500	10.0000	28.0000
Orthophosphate, mg/L (as P)	85	0.0300	0.0000	0.1000	26	0.0300	0.0100	0.0700
Chlorophyll A, ug/L	23	8.7100	0.3000	33.0000	8	6.9500	0.7000	15.0000
Chlorophyll B, ug/L	23	0.6200	0.1000	3.0000	8	0.4300	0.1000	1.4000
Ammonia Nitrogen, mg/L (as NH4)	11	0.1000	0.0400	0.2000	4	0.1400	0.0700	0.2000
Total Phosphorous, mg/L (as PO4)	34	0.1600	0.0600	0.3100	13	0.1500	0.0600	0.2500
Total Nitrogen, mg/L (as NO3)	39	4.2600	0.8000	15.0000	9	4.2400	1.7000	8.6000
Mercury, ug/L	41	0.2100	0.0000	0.5000	10	0.0700	0.0000	0.1000
Depth of Reservoir, Feet	159	16.5200	2.0000	60.0000	44	21.5500	10.0000	44.0000

Table XIX. Water Quality Data for the Hwy109 Site: Period of Record and Summer Season.

STATION 4 HWY109	PERIOD OF RECORD N	MEAN	MIN	MAX	SUMMER SEASON N	MEAN	MIN	MAX
Temperature, Celsius	83	17.6500	3.0000	30.0000	21	27.1200	23.5000	30.0000
Turbidity, FTU	72	26.4500	1.9000	300.0000	20	14.2600	1.9000	34.0000
Transparency, Inches	42	35.4800	4.0000	288.0000	11	26.2700	6.0000	46.0000
Color, Units	81	49.0100	5.0000	230.0000	20	31.8000	5.0000	80.0000
Conductivity, Micromhos/cm	91	79.1300	32.0000	165.0000	21	95.7600	52.0000	159.0000
Dissolved Oxygen, mg/L	83	6.8900	0.1000	13.1000	21	3.9200	0.1000	9.0000
Dissolved Oxygen, % Saturation	83	67.6800	1.1000	113.9000	21	49.1400	1.1000	113.9000
Biochemical Oxygen Demand, mg/L	86	2.2800	0.2000	7.8000	24	2.6900	0.2000	7.8000
pH, Standard Units	83	6.6400	5.8000	7.6000	21	6.7000	6.1000	7.5000
Carbon Dioxide, mg/L	12	12.2900	1.0000	33.0000	2	20.3000	7.6000	33.0000
Total Alkalinity, mg/L (as CaCO3)	72	21.6400	2.0000	54.0000	18	31.3900	15.0000	54.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	12	21.2500	3.0000	39.0000	2	28.0000	26.0000	30.0000
Carbonate Alkalinity, mg/L (as CO3)	12	0.0000	0.0000	0.0000	2	0.0000	0.0000	0.0000
Total Nitrogen, mg/L (as N)	39	0.9600	0.1900	3.4000	9	1.4000	0.6300	3.4000
Organic Nitrogen, mg/L (as N)	41	0.6900	0.0500	2.3000	10	0.8700	0.5000	2.3000
Ammonia Nitrogen, mg/L (as N)	50	0.0800	0.0100	0.3200	12	0.1200	0.0100	0.3200
Un-ionized Ammonia Nitrogen, mg/L (as N)	37	0.0001	0.0000	0.0008	9	0.0003	0.0001	0.0008
Total Kjeldahl Nitrogen, mg/L (as N)	50	0.7200	0.1000	2.3000	12	0.8900	0.4000	2.3000
Nitrate Nitrogen, mg/L (as N)	85	0.1700	0.0100	2.6000	23	0.2100	0.0100	2.6000
Total Phosphate, mg/L (as PO4)	15	0.0800	0.0000	0.2100	6	0.0200	0.0000	0.0300
Total Phosphorous, mg/L (as P)	85	0.0600	0.0100	0.1800	23	0.0600	0.0200	0.1400
Total Hardness, mg/L (as CaCO3)	57	23.2500	10.0000	110.0000	13	31.8500	15.0000	110.0000
Noncarbonate Hardness, mg/L (asCaCO3)	20	4.5500	0.0000	14.0000	4	5.0000	0.0000	12.0000
Calcium, mg/l (as CaCO3)	45	11.8900	4.0000	75.0000	9	19.4400	7.0000	75.0000
Dissolved Calcium, mg/L (as Ca)	54	4.4500	1.8000	30.0000	14	7.0800	1.8000	30.0000
Dissolved Magnesium, mg/L (as Mg)	54	2.7100	1.2000	7.8000	14	3.7600	1.9000	7.8000
Potassium, mg/L	41	2.0500	0.6000	5.2000	10	2.3800	1.7000	3.9000
Chloride, mg/L	48	4.4600	0.0000	9.0000	12	4.3300	1.0000	8.0000
Sulfate, mg/L	48	8.2300	1.0000	15.0000	12	6.8300	1.0000	14.0000
Arsenic, ug/L	41	1.1700	0.0000	2.0000	10	1.2000	1.0000	2.0000
Chromium, ug/L	24	10.1300	0.0000	30.0000	9	11.4400	0.0000	30.0000
Copper, ug/L	28	5.2900	0.0000	10.0000	7	4.5700	2.0000	8.0000
Iron, ug/L	48	1697.7100	480.0000	5000.0000	12	1664.1700	480.0000	4800.0000
Lead, ug/L	28	5.3600	0.0000	15.0000	7	2.2900	0.0000	4.0000
Manganese, ug/L	48	290.4200	30.0000	2700.0000	12	510.0000	90.0000	2700.0000
Nickel, ug/L	28	5.0700	2.0000	12.0000	7	3.4300	2.0000	5.0000
Zinc, ug/L	30	28.3300	10.0000	110.0000	9	17.7800	10.0000	20.0000
Aluminum, ug/L	39	501.0300	20.0000	3800.0000	10	367.0000	160.0000	1000.0000
Fecal Coliform (Colonies/100 ml)	5	22.8000	2.0000	80.0000	2	43.5000	7.0000	80.0000
Fecal Coliform (Colonies/100 ml)	40	532.2800	0.0000	7500.0000	11	43.3600	0.0000	170.0000
Calcium Hardness, mg/L (as CaCO3)	54	22.3100	10.0000	107.0000	14	33.2100	15.0000	107.0000
Orthophosphate, mg/L (as P)	85	0.0300	0.0000	0.1000	23	0.0200	0.0000	0.1000
Chlorophyll A, ug/L	23	8.7100	0.3000	33.0000	7	17.0600	2.0000	33.0000
Chlorophyll B, ug/L	23	0.6200	0.1000	3.0000	7	1.4000	0.1000	3.0000
Ammonia Nitrogen, mg/L (as NH4)	11	0.1000	0.0400	0.2000	4	0.0900	0.0400	0.2000
Total Phosphorous, mg/L (as PO4)	34	0.1600	0.0600	0.3100	11	0.1600	0.0600	0.2500
Total Nitrogen, mg/L (as NO3)	39	4.2600	0.8000	15.0000	9	6.1900	2.8000	15.0000
Mercury, ug/L	41	0.2100	0.0000	0.5000	10	0.2000	0.0000	0.5000
Depth of Reservoir, Feet	159	16.5200	2.0000	60.0000	38	11.3900	2.0000	15.0000

Table XX. Water Quality Data for the Hwy109 Site: Period of Record and Winter Season.

STATION 4	PERIOD OF RECORD				WINTER SEASON			
HWY109	N	MEAN	MIN	MAX	N	MEAN	MIN	MAX
Temperature, Celsius	83	17.6500	3.0000	30.0000	19	7.8000	4.8000	11.0000
Turbidity, FTU	72	26.4500	1.9000	300.0000	19	41.4600	3.1000	300.0000
Transparency, Inches	42	35.4800	4.0000	288.0000	10	27.8000	12.0000	72.0000
Color, Units	81	49.0100	5.0000	230.0000	19	66.9500	5.0000	230.0000
Conductivity, Micromhos/cm	91	79.1300	32.0000	165.0000	19	68.6300	35.0000	130.0000
Dissolved Oxygen, mg/L	83	6.8900	0.1000	13.1000	19	10.0800	2.9000	13.1000
Dissolved Oxygen, % Saturation	83	67.6800	1.1000	113.9000	19	83.8800	22.7000	107.4000
Biochemical Oxygen Demand, mg/L	86	2.2800	0.2000	7.8000	19	1.9100	0.4000	3.6000
pH, Standard Units	83	6.6400	5.8000	7.6000	19	6.6800	6.0000	7.4300
Total Alkalinity, mg/L (as CaCO3)	72	21.6400	2.0000	54.0000	15	17.2700	9.0000	41.0000
Total Nitrogen, mg/L (as N)	39	0.9600	0.1900	3.4000	5	1.0200	0.4000	2.4000
Organic Nitrogen, mg/L (as N)	41	0.6900	0.0500	2.3000	5	0.6600	0.0500	1.8000
Ammonia Nitrogen, mg/L (as N)	50	0.0800	0.0100	0.3200	7	0.0800	0.0300	0.1200
Un-ionized Ammonia Nitrogen, mg/L (as N)	37	0.0001	0.0000	0.0008	7	0.0001	0.0000	0.0002
Total Kjeldahl Nitrogen, mg/L (as N)	50	0.7200	0.1000	2.3000	7	0.8100	0.1700	1.8000
Nitrate Nitrogen, mg/L (as N)	85	0.1700	0.0100	2.6000	19	0.2400	0.0100	0.5500
Total Phosphate, mg/L (as PO4)	15	0.0800	0.0000	0.2100	3	0.0900	0.0300	0.1800
Total Phosphorous, mg/L (as P)	85	0.0600	0.0100	0.1800	19	0.0600	0.0200	0.1000
Total Hardness, mg/L (as CaCO3)	57	23.2500	10.0000	110.0000	11	18.7300	14.0000	36.0000
Noncarbonate Hardness, mg/L (asCaCO3)	20	4.5500	0.0000	14.0000	3	3.3300	0.0000	7.0000
Calcium, mg/l (as CaCO3)	45	11.8900	4.0000	75.0000	7	9.1400	6.0000	18.0000
Dissolved Calcium, mg/L (as Ca)	54	4.4500	1.8000	30.0000	13	3.6500	2.5000	7.0000
Dissolved Magnesium, mg/L (as Mg)	54	2.7100	1.2000	7.8000	13	2.5900	1.8000	4.4000
Potassium, mg/L	41	2.0500	0.6000	5.2000	5	2.5200	1.5000	3.4000
Chloride, mg/L	48	4.4600	0.0000	9.0000	7	5.4300	4.0000	7.0000
Sulfate, mg/L	48	8.2300	1.0000	15.0000	7	9.0000	7.0000	11.0000
Arsenic, ug/L	41	1.1700	0.0000	2.0000	5	0.8000	0.0000	1.0000
Chromium, ug/L	24	10.1300	0.0000	30.0000	5	4.0000	0.0000	10.0000
Copper, ug/L	28	5.2900	0.0000	10.0000	5	5.0000	0.0000	7.0000
Iron, ug/L	48	1697.7100	480.0000	5000.0000	7	2700.0000	1200.0000	5000.0000
Lead, ug/L	28	5.3600	0.0000	15.0000	5	3.8000	0.0000	8.0000
Manganese, ug/L	48	290.4200	30.0000	2700.0000	7	224.2900	80.0000	450.0000
Nickel, ug/L	28	5.0700	2.0000	12.0000	5	5.4000	2.0000	10.0000
Zinc, ug/L	30	28.3300	10.0000	110.0000	5	34.0000	20.0000	40.0000
Aluminum, ug/L	39	501.0300	20.0000	3800.0000	5	372.0000	110.0000	660.0000
Fecal Coliform (Colonies/100 ml)	40	532.2800	0.0000	7500.0000	10	940.3000	3.0000	5800.0000
Calcium Hardness, mg/L (as CaCO3)	54	22.3100	10.0000	107.0000	13	19.7700	14.0000	36.0000
Orthophosphate, mg/L (as P)	85	0.0300	0.0000	0.1000	19	0.0300	0.0100	0.0600
Chlorophyll A, ug/L	23	8.7100	0.3000	33.0000	7	3.4700	0.3000	21.0000
Chlorophyll B, ug/L	23	0.6200	0.1000	3.0000	7	0.1400	0.1000	0.4000
Ammonia Nitrogen, mg/L (as NH4)	11	0.1000	0.0400	0.2000	3	0.0600	0.0400	0.1000
Total Phosphorous, mg/L (as PO4)	34	0.1600	0.0600	0.3100	9	0.1700	0.0600	0.3100
Total Nitrogen, mg/L (as NO3)	39	4.2600	0.8000	15.0000	5	4.3600	1.8000	10.0000
Mercury, ug/L	41	0.2100	0.0000	0.5000	5	0.0400	0.0000	0.1000
Depth of Reservoir, Feet	159	16.5200	2.0000	60.0000	34	20.2600	9.0000	60.0000

Table XXI. Water Quality Data for the Sugar Grove Site: Period of Record and Spring Season.

STATION 5 SUGAR GROVE	PERIOD OF RECORD N	MEAN	MIN	MAX	SPRING SEASON N	MEAN	MIN	MAX
Temperature, Celsius	38	16.2800	3.0000	27.5000	13	19.3100	15.5000	24.0000
Turbidity, FTU	33	11.6500	2.0000	53.0000	13	13.5000	3.5000	53.0000
Transparency, Inches	31	35.9400	4.0000	288.0000	11	31.4500	4.0000	48.0000
Color, Units	38	36.4700	5.0000	130.0000	13	36.3800	5.0000	100.0000
Conductivity, Micromhos/cm	38	42.0800	28.0000	64.0000	13	35.9200	28.0000	48.0000
Dissolved Oxygen, mg/L	37	8.8300	4.2000	12.7000	12	7.7800	4.4000	9.8000
Dissolved Oxygen, % Saturation	37	85.7400	48.9000	110.7000	12	83.1900	48.9000	104.3000
Biochemical Oxygen Demand, mg/L	16	1.3000	0.2000	2.6000	7	1.4700	0.9000	2.6000
pH, Standard Units	38	6.6100	5.9200	7.5300	13	6.4400	5.9200	6.9000
Carbon Dioxide, mg/L	3	2.6300	2.0000	3.2000	1	3.2000	3.2000	3.2000
Total Alkalinity, mg/L (as CaCO3)	32	11.3800	2.0000	30.0000	11	9.1800	6.0000	13.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	2	10.5000	5.0000	16.0000	1	16.0000	16.0000	16.0000
Ammonia Nitrogen, mg/L (as N)	1	0.3100	0.3100	0.3100	1	0.3100	0.3100	0.3100
Un-ionized Ammonia Nitrogen, mg/L (as N)	1	0.0003	0.0003	0.0003	1	0.0003	0.0003	0.0003
Total Kjeldahl Nitrogen, mg/L (as N)	1	0.4000	0.4000	0.4000	1	0.4000	0.4000	0.4000
Nitrate Nitrogen, mg/L (as N)	15	0.0800	0.0200	0.2000	7	0.0800	0.0200	0.1000
Total Phosphorous, mg/L (as P)	15	0.0300	0.0100	0.0700	7	0.0300	0.0100	0.0700
Total Hardness, mg/L (as CaCO3)	27	12.5200	1.0000	32.0000	8	10.8800	7.0000	17.0000
Noncarbonate Hardness, mg/L (asCaCO3)	10	1.9000	0.0000	7.0000	3	0.3300	0.0000	1.0000
Calcium, mg/l (as CaCO3)	23	5.2200	1.0000	14.0000	6	4.5000	2.0000	6.0000
Dissolved Calcium, mg/L (as Ca)	26	1.8500	0.4000	3.1000	10	1.8100	1.0000	2.6000
Dissolved Magnesium, mg/L (as Mg)	26	1.4000	0.1000	2.2000	10	1.3500	0.9000	2.0000
Chloride, mg/L	4	2.2500	1.0000	4.0000	1	2.0000	2.0000	2.0000
Fecal Coliform (Colonies/100 ml)	4	32.7500	20.0000	37.0000				
Fecal Coliform (Colonies/100 ml)	34	317.5600	1.0000	6000.0000	13	537.0800	10.0000	6000.0000
Calcium Hardness, mg/L (as CaCO3)	26	10.3800	1.0000	16.0000	10	10.1000	8.0000	15.0000
Orthophosphate, mg/L (as P)	15	0.0100	0.0100	0.0300	7	0.0100	0.0100	0.0300
Chlorophyll A, ug/L	19	1.1600	0.1000	9.0000	8	0.8800	0.1000	1.9000
Chlorophyll B, ug/L	19	0.1400	0.1000	0.5000	8	0.1400	0.1000	0.4000
Total Phosphorous, mg/L (as PO4)	1	0.0600	0.0600	0.0600				
Depth of Reservoir, Feet	84	6.0700	0.5000	30.0000	26	7.4200	2.0000	28.0000

Table XXII. Water Quality Data for the Sugar Grove Site: Period of Record and Summer Season.

STATION 5 SUGAR GROVE	PERIOD OF RECORD N	MEAN	MIN	MAX	SUMMER SEASON N	MEAN	MIN	MAX
Temperature, Celsius	38	16.2800	3.0000	27.5000	6	26.0000	24.0000	27.5000
Turbidity, FTU	33	11.6500	2.0000	53.0000	6	6.8700	3.5000	18.0000
Transparency, Inches	31	35.9400	4.0000	288.0000	5	19.6000	9.0000	29.0000
Color, Units	38	36.4700	5.0000	130.0000	6	26.3300	10.0000	50.0000
Conductivity, Micromhos/cm	38	42.0800	28.0000	64.0000	6	51.8300	44.0000	64.0000
Dissolved Oxygen, mg/L	37	8.8300	4.2000	12.7000	6	5.7000	4.2000	6.3000
Dissolved Oxygen, % Saturation	37	85.7400	48.9000	110.7000	6	68.7300	51.9000	76.8000
Biochemical Oxygen Demand, mg/L	16	1.3000	0.2000	2.6000	2	1.7000	1.6000	1.8000
pH, Standard Units	38	6.6100	5.9200	7.5300	6	6.5200	6.0000	7.0000
Carbon Dioxide, mg/L	3	2.6300	2.0000	3.2000				
Total Alkalinity, mg/L (as CaCO3)	32	11.3800	2.0000	30.0000	4	15.0000	8.0000	20.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	2	10.5000	5.0000	16.0000				
Ammonia Nitrogen, mg/L (as N)	1	0.3100	0.3100	0.3100				
Un-ionized Ammonia Nitrogen, mg/L (as N)	1	0.0003	0.0003	0.0003				
Total Kjeldahl Nitrogen, mg/L (as N)	1	0.4000	0.4000	0.4000				
Nitrate Nitrogen, mg/L (as N)	15	0.0800	0.0200	0.2000	2	0.0600	0.0200	0.1000
Total Phosphorous, mg/L (as P)	15	0.0300	0.0100	0.0700	2	0.0200	0.0200	0.0200
Total Hardness, mg/L (as CaCO3)	27	12.5200	1.0000	32.0000	4	10.5000	1.0000	15.0000
Noncarbonate Hardness, mg/L (asCaCO3)	10	1.9000	0.0000	7.0000	1	7.0000	7.0000	7.0000
Calcium, mg/l (as CaCO3)	23	5.2200	1.0000	14.0000	4	5.5000	1.0000	8.0000
Dissolved Calcium, mg/L (as Ca)	26	1.8500	0.4000	3.1000	5	2.1200	0.4000	2.9000
Dissolved Magnesium, mg/L (as Mg)	26	1.4000	0.1000	2.2000	5	1.5000	0.1000	1.9000
Chloride, mg/L	4	2.2500	1.0000	4.0000	1	2.0000	2.0000	2.0000
Fecal Coliform (Colonies/100 ml)	4	32.7500	20.0000	37.0000	1	37.0000	37.0000	37.0000
Fecal Coliform (Colonies/100 ml)	34	317.5600	1.0000	6000.0000	5	83.0000	30.0000	170.0000
Calcium Hardness, mg/L (as CaCO3)	26	10.3800	1.0000	16.0000	5	11.4000	1.0000	15.0000
Orthophosphate, mg/L (as P)	15	0.0100	0.0100	0.0300	2	0.0100	0.0100	0.0100
Chlorophyll A, ug/L	19	1.1600	0.1000	9.0000	3	3.8700	1.0000	9.0000
Chlorophyll B, ug/L	19	0.1400	0.1000	0.5000	3	0.2300	0.1000	0.5000
Total Phosphorous, mg/L (as PO4)	1	0.0600	0.0600	0.0600				
Depth of Reservoir, Feet	84	6.0700	0.5000	30.0000	12	2.5000	1.0000	6.0000

Table XXIII. Water Quality Data for the Sugar Grove Site: Period of Record and Winter Season.

STATION 5 SUGAR GROVE	PERIOD OF RECORD N	MEAN	MIN	MAX	WINTER SEASON N	MEAN	MIN	MAX
Temperature, Celsius	38	16.2800	3.0000	27.5000	10	8.1500	3.3000	11.0000
Turbidity, FTU	33	11.6500	2.0000	53.0000	10	13.1200	2.0000	30.0000
Transparency, Inches	31	35.9400	4.0000	288.0000	10	26.8000	12.0000	42.0000
Color, Units	38	36.4700	5.0000	130.0000	10	38.8000	5.0000	90.0000
Conductivity, Micromhos/cm	38	42.0800	28.0000	64.0000	10	38.0000	28.0000	53.0000
Dissolved Oxygen, mg/L	37	8.8300	4.2000	12.7000	10	11.0700	9.4000	12.7000
Dissolved Oxygen, % Saturation	37	85.7400	48.9000	110.7000	10	92.6700	73.4000	106.4000
Biochemical Oxygen Demand, mg/L	16	1.3000	0.2000	2.6000	6	1.0300	0.2000	1.6000
pH, Standard Units	38	6.6100	5.9200	7.5300	10	6.6600	6.1000	7.5300
Carbon Dioxide, mg/L	3	2.6300	2.0000	3.2000				
Total Alkalinity, mg/L (as CaCO3)	32	11.3800	2.0000	30.0000	8	10.0000	5.0000	20.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	2	10.5000	5.0000	16.0000				
Ammonia Nitrogen, mg/L (as N)	1	0.3100	0.3100	0.3100				
Un-ionized Ammonia Nitrogen, mg/L (as N)	1	0.0003	0.0003	0.0003				
Total Kjeldahl Nitrogen, mg/L (as N)	1	0.4000	0.4000	0.4000				
Nitrate Nitrogen, mg/L (as N)	15	0.0800	0.0200	0.2000	6	0.0800	0.0200	0.2000
Total Phosphorous, mg/L (as P)	15	0.0300	0.0100	0.0700	6	0.0300	0.0200	0.0500
Total Hardness, mg/L (as CaCO3)	27	12.5200	1.0000	32.0000	6	10.3300	6.0000	16.0000
Noncarbonate Hardness, mg/L (asCaCO3)	10	1.9000	0.0000	7.0000	2	0.0000	0.0000	0.0000
Calcium, mg/l (as CaCO3)	23	5.2200	1.0000	14.0000	4	4.7500	3.0000	8.0000
Dissolved Calcium, mg/L (as Ca)	26	1.8500	0.4000	3.1000	7	1.8900	1.2000	3.1000
Dissolved Magnesium, mg/L (as Mg)	26	1.4000	0.1000	2.2000	7	1.4300	1.0000	2.2000
Chloride, mg/L	4	2.2500	1.0000	4.0000	1	4.0000	4.0000	4.0000
Fecal Coliform (Colonies/100 ml)	4	32.7500	20.0000	37.0000				
Fecal Coliform (Colonies/100 ml)	34	317.5600	1.0000	6000.0000	10	271.5000	1.0000	1600.0000
Calcium Hardness, mg/L (as CaCO3)	26	10.3800	1.0000	16.0000	7	10.7100	7.0000	16.0000
Orthophosphate, mg/L (as P)	15	0.0100	0.0100	0.0300	6	0.0100	0.0100	0.0200
Chlorophyll A, ug/L	19	1.1600	0.1000	9.0000	7	0.4600	0.1000	1.9000
Chlorophyll B, ug/L	19	0.1400	0.1000	0.5000	7	0.1000	0.1000	0.1000
Total Phosphorous, mg/L (as PO4)	1	0.0600	0.0600	0.0600	1	0.0600	0.0600	0.0600
Depth of Reservoir, Feet	84	6.0700	0.5000	30.0000	24	9.0000	1.0000	30.0000

Table XXIV. Water Quality Data for the Narrows Site: Period of Record and Spring Season.

STATION 6	PERIOD OF RECORD				SPRING SEASON			
NARROWS	N	MEAN	MIN	MAX	N	MEAN	MIN	MAX
Temperature, Celsius	45	17.8200	3.0000	30.0000	13	20.1200	16.5000	25.0000
Turbidity, FTU	37	28.7100	2.0000	130.0000	12	31.9000	2.8000	120.0000
Transparency, Inches	40	20.8300	2.0000	216.0000	12	15.2500	2.0000	30.0000
Color, Units	44	53.6400	3.0000	180.0000	13	46.3800	5.0000	100.0000
Conductivity, Micromhos/cm	45	86.6200	38.0000	171.0000	13	70.2300	56.0000	100.0000
Dissolved Oxygen, mg/L	45	7.5400	0.1000	12.5000	13	7.8300	6.4000	8.8000
Dissolved Oxygen, % Saturation	45	74.2100	1.2000	102.5000	13	85.0100	70.2000	98.9000
Biochemical Oxygen Demand, mg/L	41	2.3900	0.5000	5.9000	12	2.1600	0.8000	5.9000
pH, Standard Units	45	6.7800	6.0000	8.3000	13	6.6500	6.1000	7.1000
Carbon Dioxide, mg/L	3	3.2300	2.6000	3.7000	1	3.4000	3.4000	3.4000
Total Alkalinity, mg/L (as CaCO3)	39	23.7200	7.0000	55.0000	11	17.6400	10.0000	27.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	2	20.0000	13.0000	27.0000	1	27.0000	27.0000	27.0000
Ammonia Nitrogen, mg/L (as N)	1	0.2100	0.2100	0.2100	1	0.2100	0.2100	0.2100
Un-ionized Ammonia Nitrogen, mg/L (as N)	1	0.0004	0.0004	0.0004	1	0.0004	0.0004	0.0004
Total Kjeldahl Nitrogen, mg/L (as N)	1	0.8000	0.8000	0.8000	1	0.8000	0.8000	0.8000
Nitrate Nitrogen, mg/L (as N)	19	0.1500	0.0200	0.5000	7	0.1500	0.0200	0.3000
Total Phosphorous, mg/L (as P)	20	0.1200	0.0100	1.1000	7	0.0800	0.0500	0.2000
Total Hardness, mg/L (as CaCO3)	30	24.1300	1.0000	56.0000	8	18.7500	12.0000	24.0000
Noncarbonate Hardness, mg/L (asCaCO3)	11	6.2700	0.0000	21.0000	3	4.0000	2.0000	7.0000
Calcium, mg/l (as CaCO3)	25	11.8400	1.0000	28.0000	6	8.0000	6.0000	12.0000
Dissolved Calcium, mg/L (as Ca)	29	4.3800	0.4000	11.0000	10	3.4300	2.3000	4.8000
Dissolved Magnesium, mg/L (as Mg)	29	2.9100	0.1000	5.8000	10	2.3600	1.4000	3.5000
Chloride, mg/L	4	3.5000	2.0000	6.0000	1	3.0000	3.0000	3.0000
Fecal Coliform (Colonies/100 ml)	3	57.0000	7.0000	140.0000				
Fecal Coliform (Colonies/100 ml)	37	458.3000	0.0000	9000.0000	13	893.5400	0.0000	9000.0000
Calcium Hardness, mg/L (as CaCO3)	29	22.9300	1.0000	51.0000	10	18.3000	12.0000	26.0000
Orthophosphate, mg/L (as P)	19	0.0300	0.0100	0.1100	7	0.0400	0.0100	0.1100
Chlorophyll A, ug/L	23	6.5700	0.1000	27.0000	8	7.2100	0.9000	22.0000
Chlorophyll B, ug/L	23	0.8100	0.1000	3.3000	8	0.7500	0.1000	3.3000
Total Phosphorous, mg/L (as PO4)	4	0.1900	0.0900	0.2800	2	0.2000	0.1500	0.2500
Depth of Reservoir, Feet	104	6.9400	1.5000	28.0000	30	10.4000	2.0000	28.0000

Table XXV. Water Quality Data for the Narrows Site: Period of Record and Summer Season.

STATION 6 NARROWS	PERIOD OF RECORD N	MEAN	MIN	MAX	SUMMER SEASON N	MEAN	MIN	MAX
Temperature, Celsius	45	17.8200	3.0000	30.0000	13	26.8800	23.5000	30.0000
Turbidity, FTU	37	28.7100	2.0000	130.0000	11	18.3400	2.0000	56.0000
Transparency, Inches	40	20.8300	2.0000	216.0000	11	14.6400	6.0000	24.0000
Color, Units	44	53.6400	3.0000	180.0000	12	49.5800	3.0000	160.0000
Conductivity, Micromhos/cm	45	86.6200	38.0000	171.0000	13	100.0000	62.0000	171.0000
Dissolved Oxygen, mg/L	45	7.5400	0.1000	12.5000	13	3.9200	0.1000	7.5000
Dissolved Oxygen, % Saturation	45	74.2100	1.2000	102.5000	13	48.3100	1.2000	91.5000
Biochemical Oxygen Demand, mg/L	41	2.3900	0.5000	5.9000	11	2.6300	1.9000	3.5000
pH, Standard Units	45	6.7800	6.0000	8.3000	13	6.9000	6.3800	8.3000
Carbon Dioxide, mg/L	3	3.2300	2.6000	3.7000				
Total Alkalinity, mg/L (as CaCO3)	39	23.7200	7.0000	55.0000	11	32.0000	12.0000	55.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	2	20.0000	13.0000	27.0000				
Ammonia Nitrogen, mg/L (as N)	1	0.2100	0.2100	0.2100				
Un-ionized Ammonia Nitrogen, mg/L (as N)	1	0.0004	0.0004	0.0004				
Total Kjeldahl Nitrogen, mg/L (as N)	1	0.8000	0.8000	0.8000				
Nitrate Nitrogen, mg/L (as N)	19	0.1500	0.0200	0.5000	6	0.0900	0.0200	0.2000
Total Phosphorous, mg/L (as P)	20	0.1200	0.0100	1.1000	7	0.2100	0.0200	1.1000
Total Hardness, mg/L (as CaCO3)	30	24.1300	1.0000	56.0000	7	25.7100	1.0000	51.0000
Noncarbonate Hardness, mg/L (asCaCO3)	11	6.2700	0.0000	21.0000	2	10.5000	0.0000	21.0000
Calcium, mg/l (as CaCO3)	25	11.8400	1.0000	28.0000	6	12.1700	1.0000	28.0000
Dissolved Calcium, mg/L (as Ca)	29	4.3800	0.4000	11.0000	8	4.9400	0.4000	11.0000
Dissolved Magnesium, mg/L (as Mg)	29	2.9100	0.1000	5.8000	8	3.3600	0.1000	5.7000
Chloride, mg/L	4	3.5000	2.0000	6.0000	1	2.0000	2.0000	2.0000
Fecal Coliform (Colonies/100 ml)	3	57.0000	7.0000	140.0000	1	140.0000	140.0000	140.0000
Fecal Coliform (Colonies/100 ml)	37	458.3000	0.0000	9000.0000	9	123.7800	33.0000	440.0000
Calcium Hardness, mg/L (as CaCO3)	29	22.9300	1.0000	51.0000	8	26.1300	1.0000	51.0000
Orthophosphate, mg/L (as P)	19	0.0300	0.0100	0.1100	6	0.0200	0.0100	0.0400
Chlorophyll A, ug/L	23	6.5700	0.1000	27.0000	7	11.0900	0.1000	27.0000
Chlorophyll B, ug/L	23	0.8100	0.1000	3.3000	7	1.6900	0.1000	3.2000
Total Phosphorous, mg/L (as PO4)	4	0.1900	0.0900	0.2800	1	0.0900	0.0900	0.0900
Depth of Reservoir, Feet	104	6.9400	1.5000	28.0000	26	4.4000	1.5000	10.0000

Table XXVI Water Quality Data for the Narrows Site: Period of Record and Winter Season.

STATION 6	PERIOD OF RECORD				WINTER SEASON			
NARROWS	N	MEAN	MIN	MAX	N	MEAN	MIN	MAX
Temperature, Celsius	45	17.8200	3.0000	30.0000	10	7.4000	3.3000	10.5000
Turbidity, FTU	37	28.7100	2.0000	130.0000	10	26.6700	2.3000	130.0000
Transparency, Inches	40	20.8300	2.0000	216.0000	10	19.3000	5.0000	48.0000
Color, Units	44	53.6400	3.0000	180.0000	10	57.3000	10.0000	180.0000
Conductivity, Micromhos/cm	45	86.6200	38.0000	171.0000	10	85.0000	38.0000	156.0000
Dissolved Oxygen, mg/L	45	7.5400	0.1000	12.5000	10	10.2500	4.2000	12.5000
Dissolved Oxygen, % Saturation	45	74.2100	1.2000	102.5000	10	84.6900	32.1000	102.5000
Biochemical Oxygen Demand, mg/L	41	2.3900	0.5000	5.9000	10	2.2700	0.7000	5.8000
pH, Standard Units	45	6.7800	6.0000	8.3000	10	6.7700	6.1000	7.6000
Carbon Dioxide, mg/L	3	3.2300	2.6000	3.7000				
Total Alkalinity, mg/L (as CaCO3)	39	23.7200	7.0000	55.0000	8	22.2500	9.0000	55.0000
Bicarbonate Alkalinity, mg/L (as HCO3)	2	20.0000	13.0000	27.0000				
Ammonia Nitrogen, mg/L (as N)	1	0.2100	0.2100	0.2100				
Un-ionjzed Ammonia Nitrogen, mg/L (as N)	1	0.0004	0.0004	0.0004				
Total Kjeldahl Nitrogen, mg/L (as N)	1	0.8000	0.8000	0.8000				
Nitrate Nitrogen, mg/L (as N)	19	0.1500	0.0200	0.5000	6	0.2300	0.0200	0.5000
Total Phosphorous, mg/L (as P)	20	0.1200	0.0100	1.1000	6	0.0600	0.0100	0.0900
Total Hardness, mg/L (as CaCO3)	30	24.1300	1.0000	56.0000	6	20.8300	8.0000	42.0000
Noncarbonate Hardness, mg/L (asCaCO3)	11	6.2700	0.0000	21.0000	2	2.5000	0.0000	5.0000
Calcium, mg/l (as CaCO3)	25	11.8400	1.0000	28.0000	4	11.0000	7.0000	22.0000
Dissolved Calcium, mg/L (as Ca)	29	4.3800	0.4000	11.0000	7	4.7000	2.7000	8.7000
Dissolved Magnesium, mg/L (as Mg)	29	2.9100	0.1000	5.8000	7	3.3100	2.1000	5.8000
Chloride, mg/L	4	3.5000	2.0000	6.0000	1	6.0000	6.0000	6.0000
Fecal Coliform (Colonies/100 ml)	3	57.0000	7.0000	140.0000				
Fecal Coliform (Colonies/100 ml)	37	458.3000	0.0000	9000.0000	9	261.0000	9.0000	1300.0000
Calcium Hardness, mg/L (as CaCO3)	29	22.9300	1.0000	51.0000	7	25.4300	16.0000	45.0000
Orthophosphate, mg/L (as P)	19	0.0300	0.0100	0.1100	6	0.0400	0.0100	0.0600
Chlorophyll A, ug/L	23	6.5700	0.1000	27.0000	7	2.0000	0.1000	11.0000
Chlorophyll B, ug/L	23	0.8100	0.1000	3.3000	7	0.1100	0.1000	0.2000
Total Phosphorous, mg/L (as PO4)	4	0.1900	0.0900	0.2800	1	0.2800	0.2800	0.2800
Depth of Reservoir, Feet	104	6.9400	1.5000	28.0000	24	8.0000	4.0000	20.0000

APPENDIX A

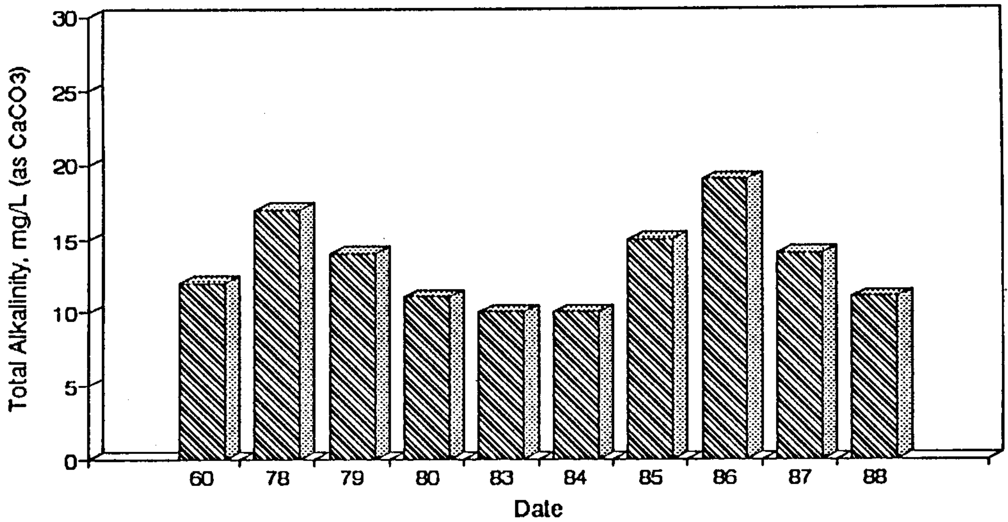

Figure A1. Graph of Total Alkalinity vs. Time for the Petit Site-Aug.

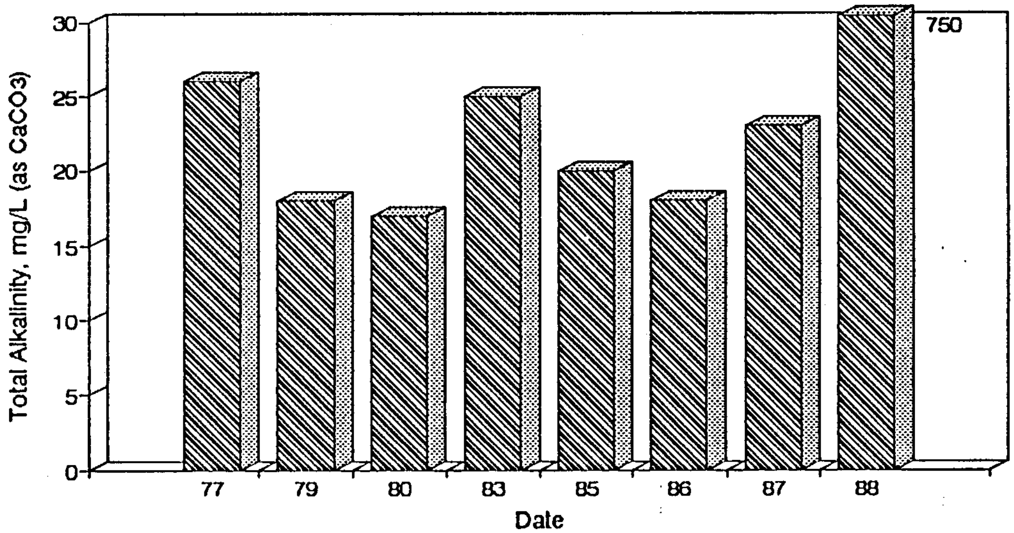

Figure A2. Graph of Total Alkalinity vs. Time for the Petit Site-Aug.

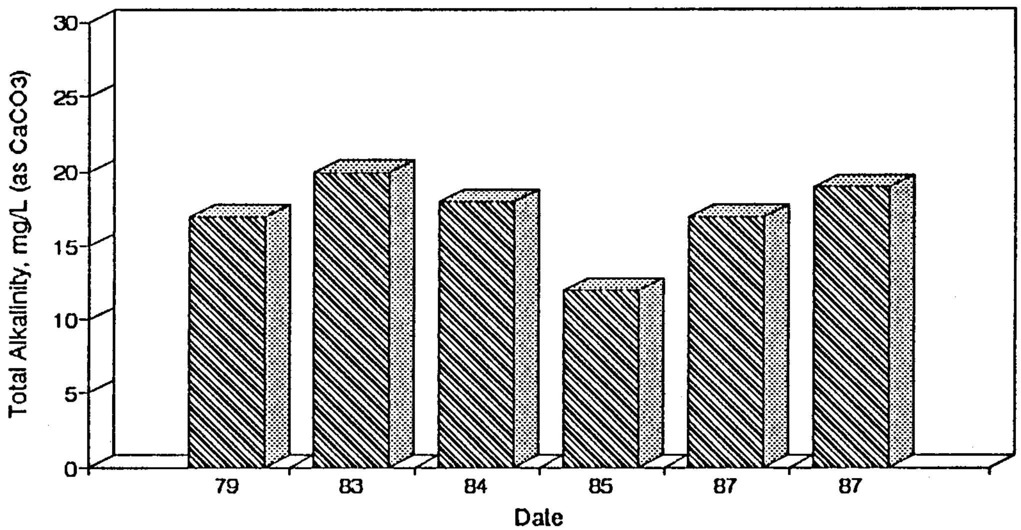

Figure A3. Graph of Total Alkalinity vs. Time for the Petit Site-Dec.

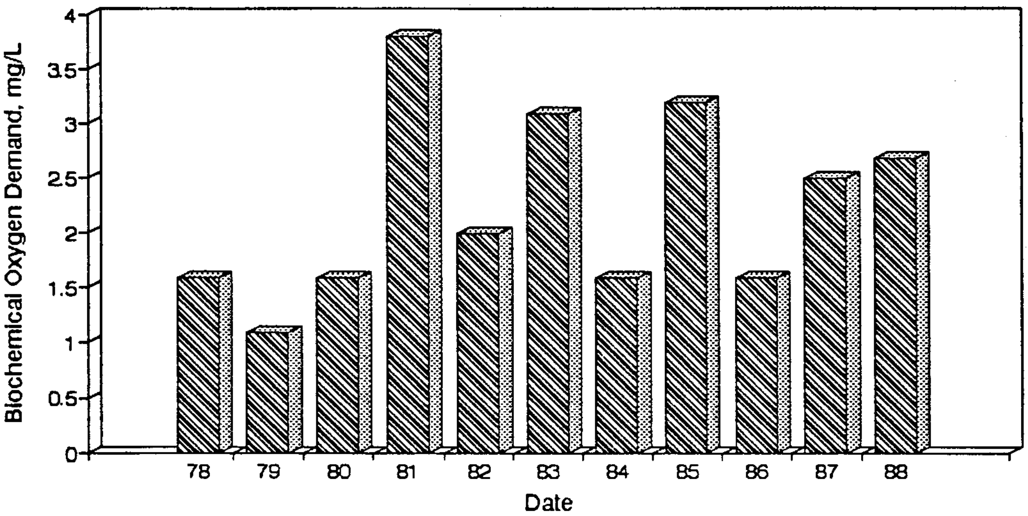

Figure A4. Graph of Biochemical Oxygen Demand vs. Time for the Petit Site-May.

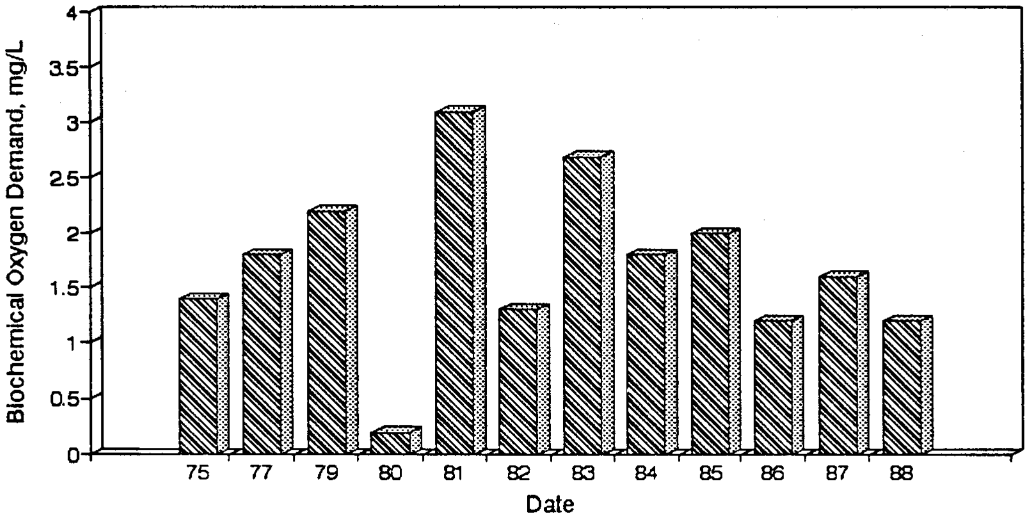

Figure A5. Graph of Biochemical Oxygen Demand vs. Time for the Petit Site-Aug.

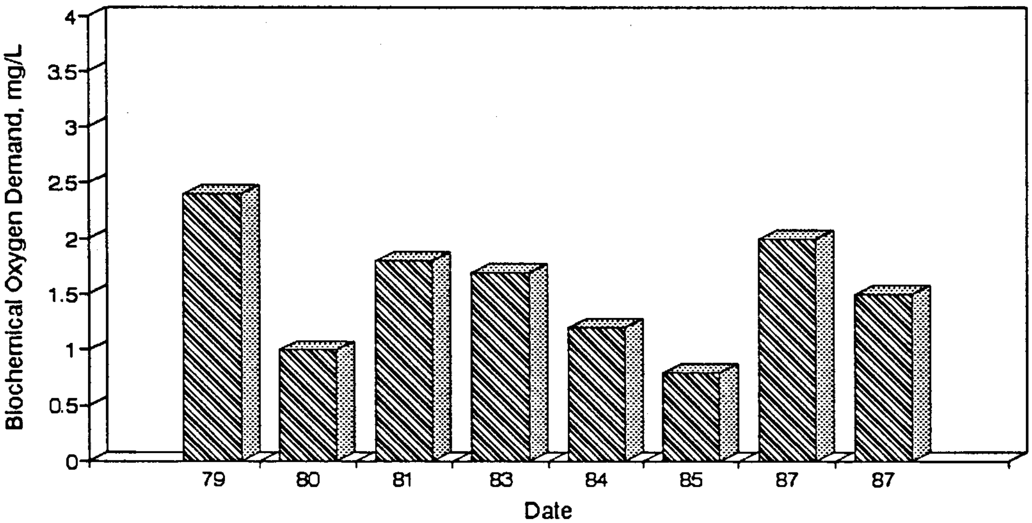

Figure A6. Graph of Biochemical Oxygen Demand vs. Time for the Petit Site-Dec.

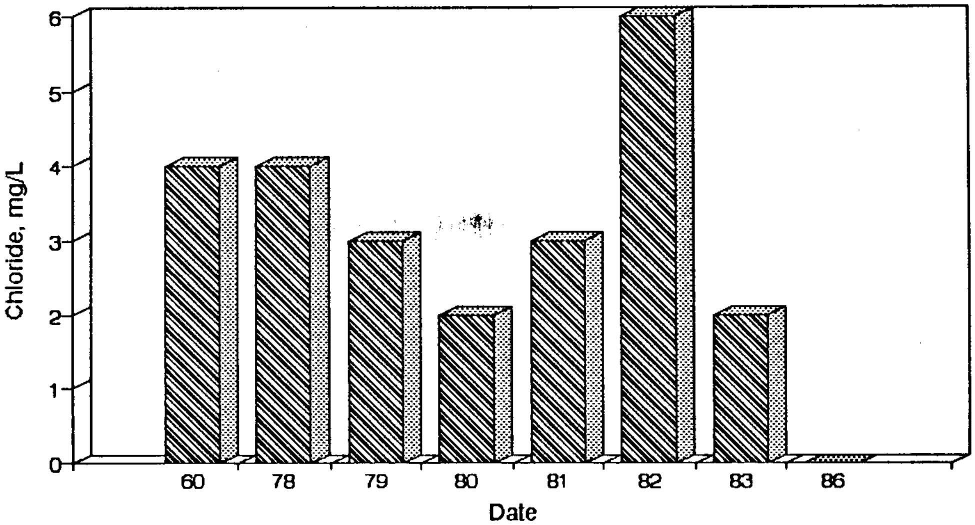

Figure A7. Graph of Chloride vs. Time for the Petit Site-May.

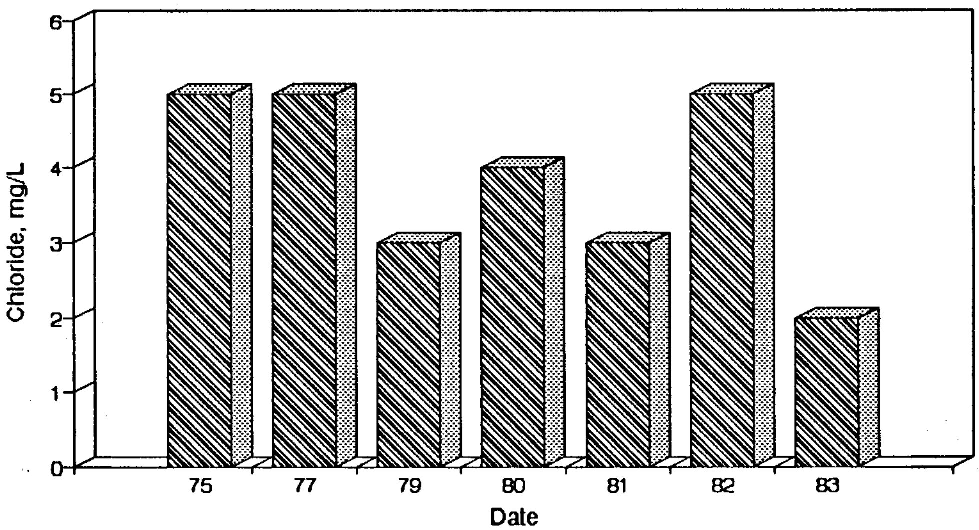

Figure A8. Graph of Chloride vs. Time for the Petit Site-Aug.

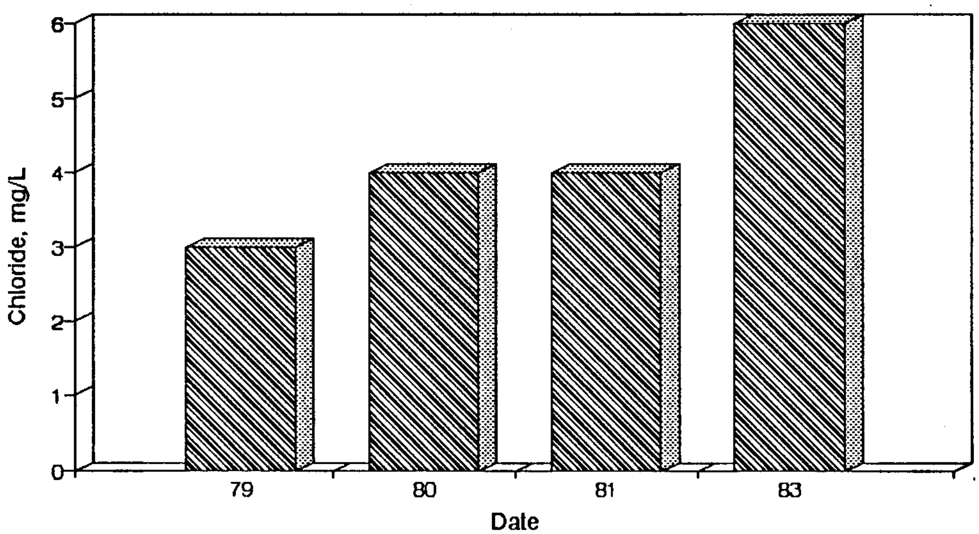

Figure A9. Graph of Chloride vs. Time for the Petit Site-Dec.

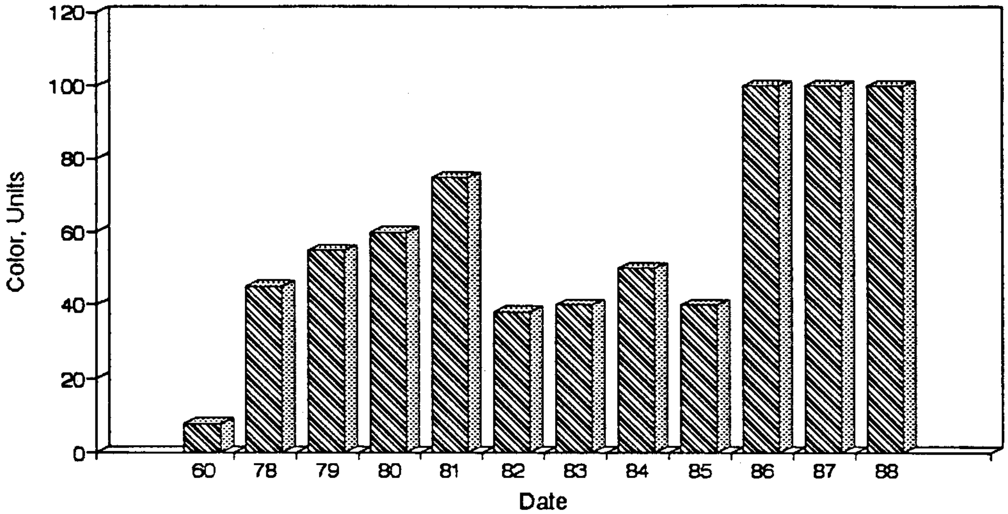

Figure A10. Graph of Color vs. Time for the Petit Site-May.

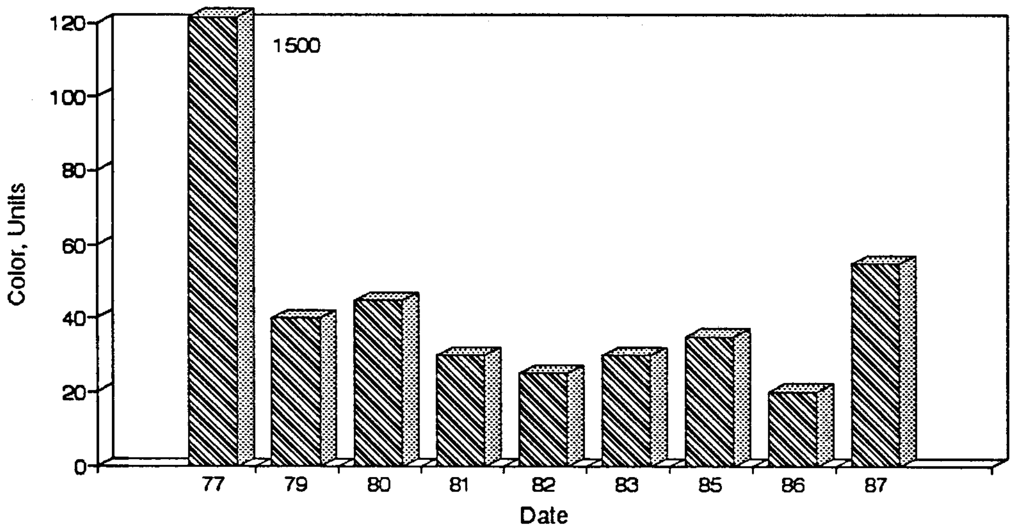

Figure A11. Graph of Color vs. Time for the Petit Site-Aug.

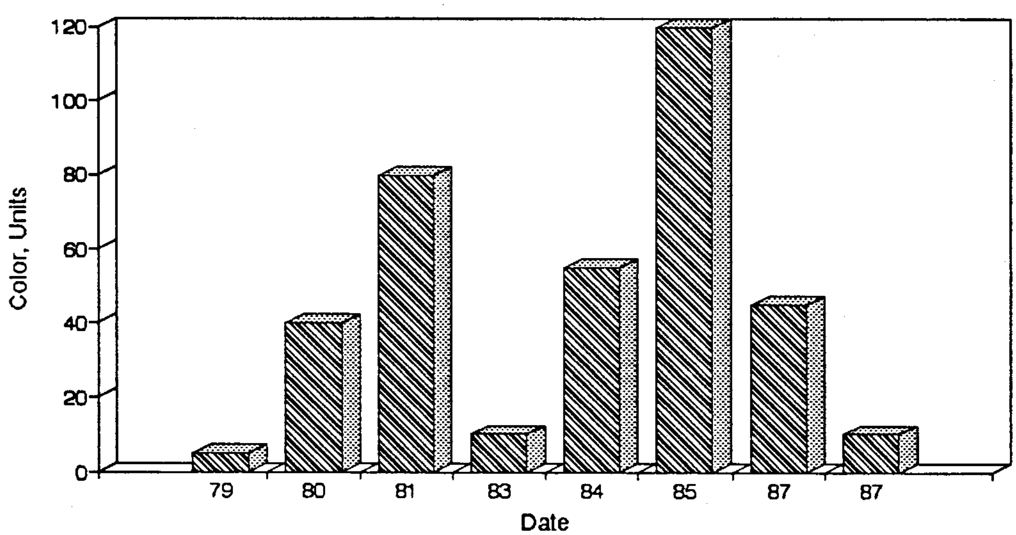

Figure A12. Graph of Color vs. Time for the Petit Site-Dec.

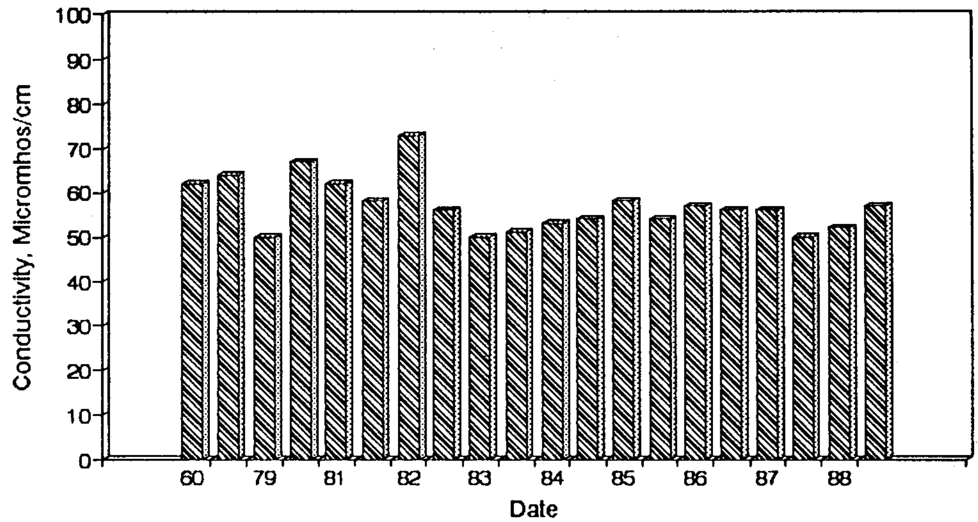

Figure A13. Graph of Conductivity vs. Time for the Petit Site-May.

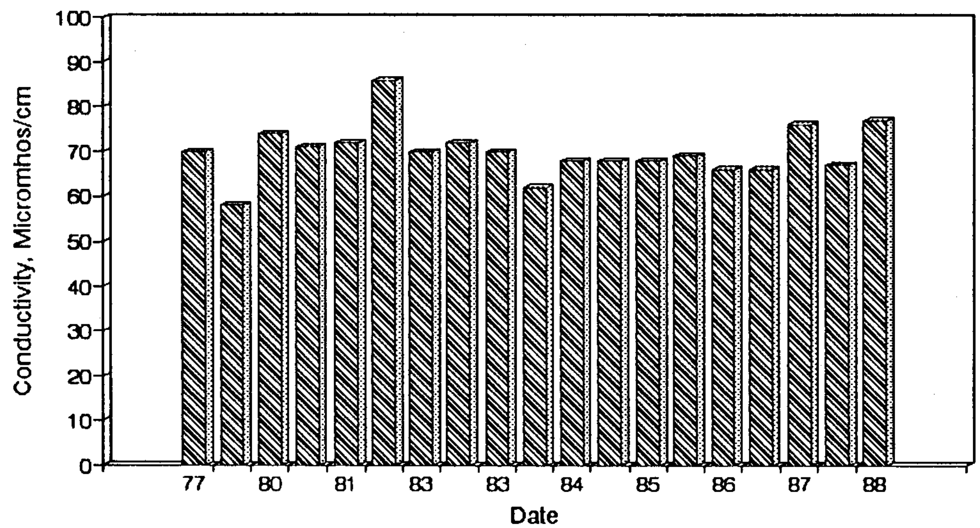

Figure A14. Graph of Conductivity vs. Time for the Petit Site-Aug.

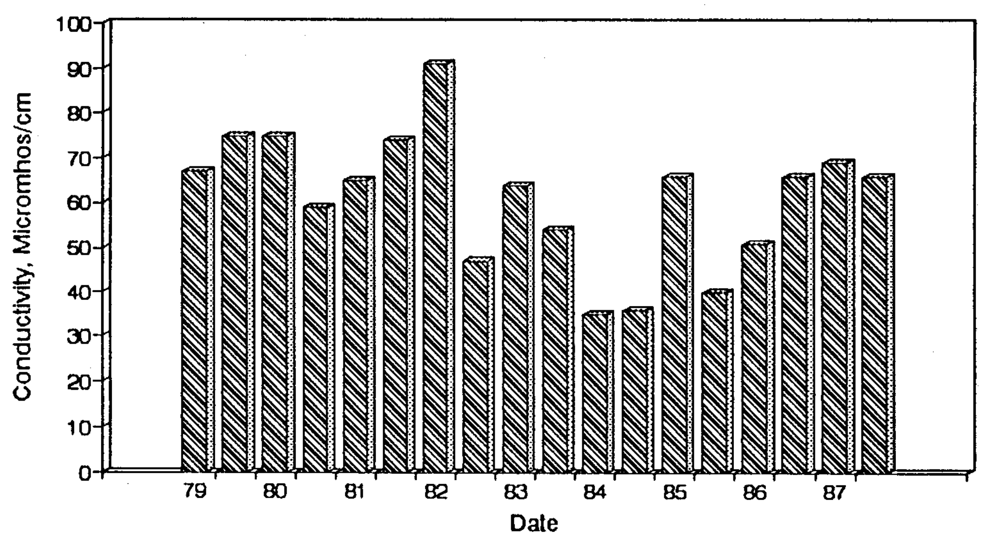

Figure A15. Graph of Conductivity vs. Time for the Petit Site-Dec.

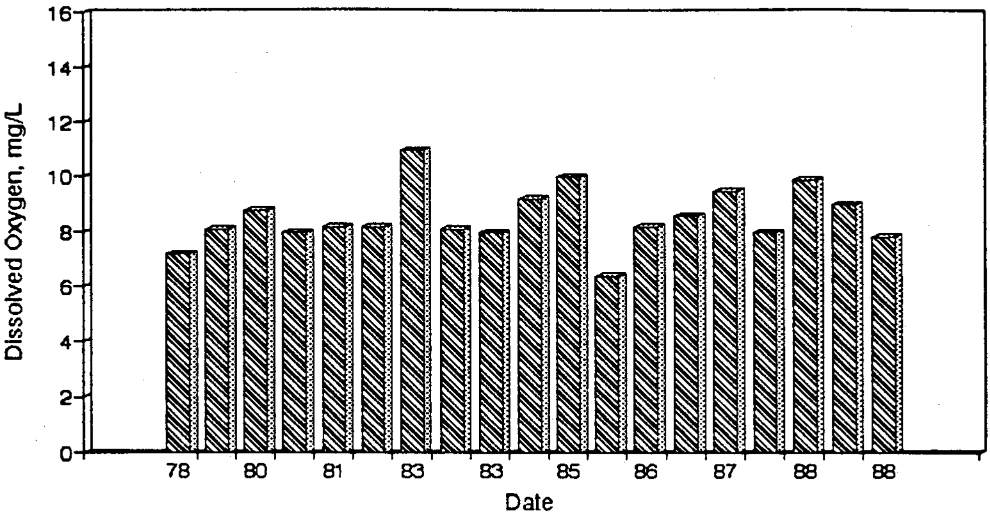

Figure A16. Graph of Dissolved Oxygen vs. Time for the Petit Site-May.

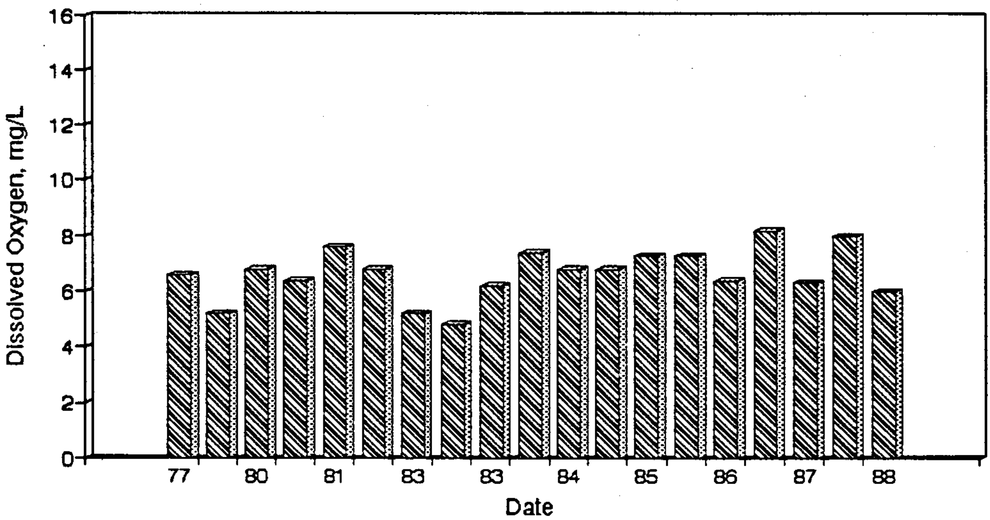

Figure A17. Graph of Dissolved Oxygen vs. Time for the Petit Site-Aug.

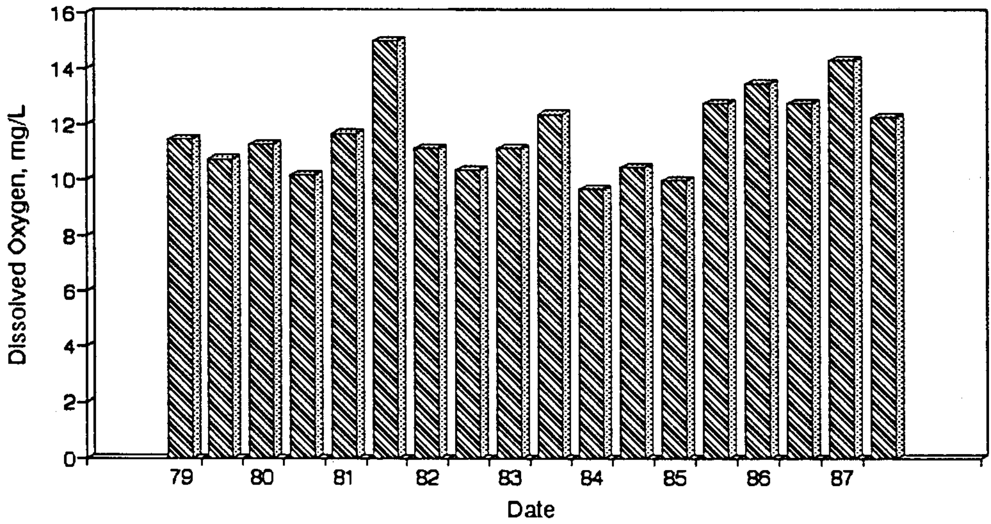

Figure A18. Graph of Dissolved Oxygen vs. Time for the Petit Site-Dec.

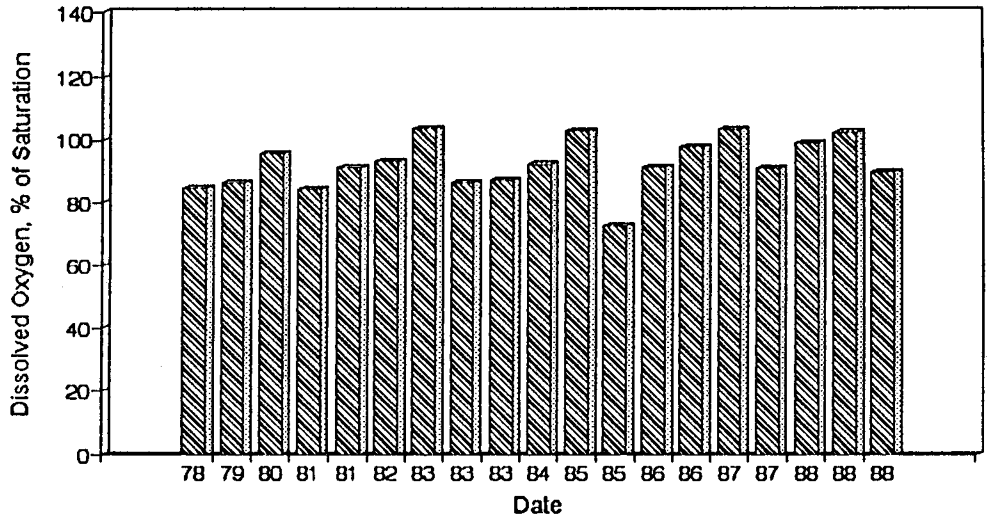

Figure A19. Graph of Dissolved Oxygen vs. Time for the Petit Site-May.

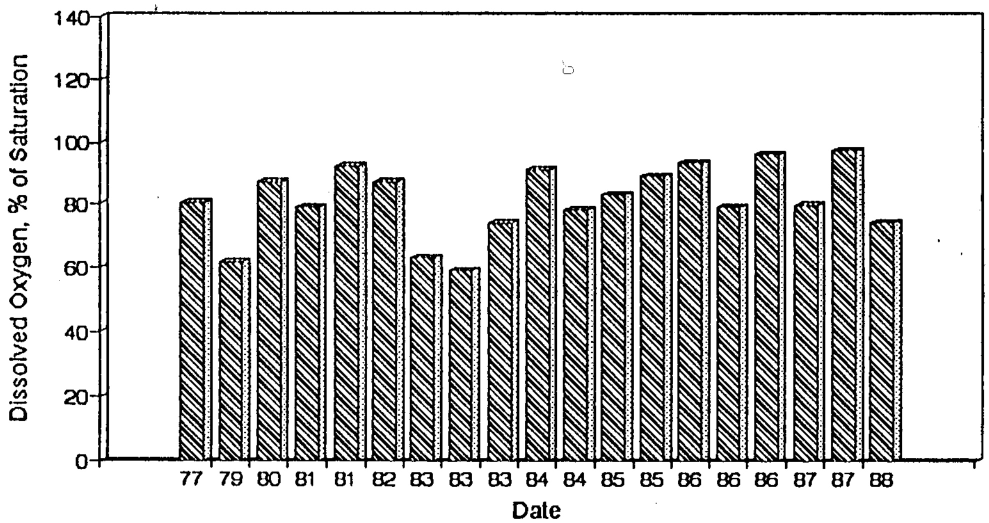

Figure A20. Graph of Dissolved Oxygen vs. Time for the Petit Site-Aug.

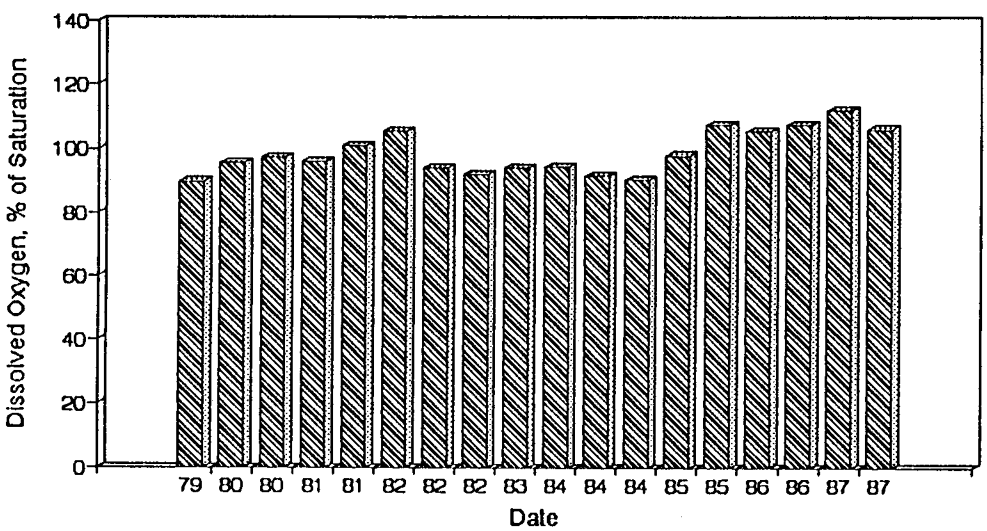

Figure A21. Graph of Dissolved Oxygen vs. Time for the Petit Site-Dec.

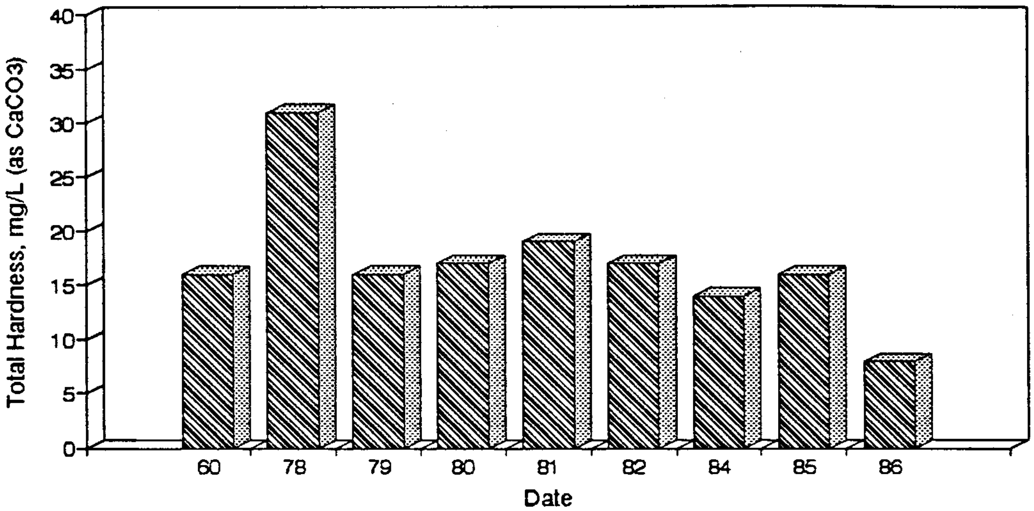

Figure A22. Graph of Total Hardness vs. Time for the Petit Site-May.

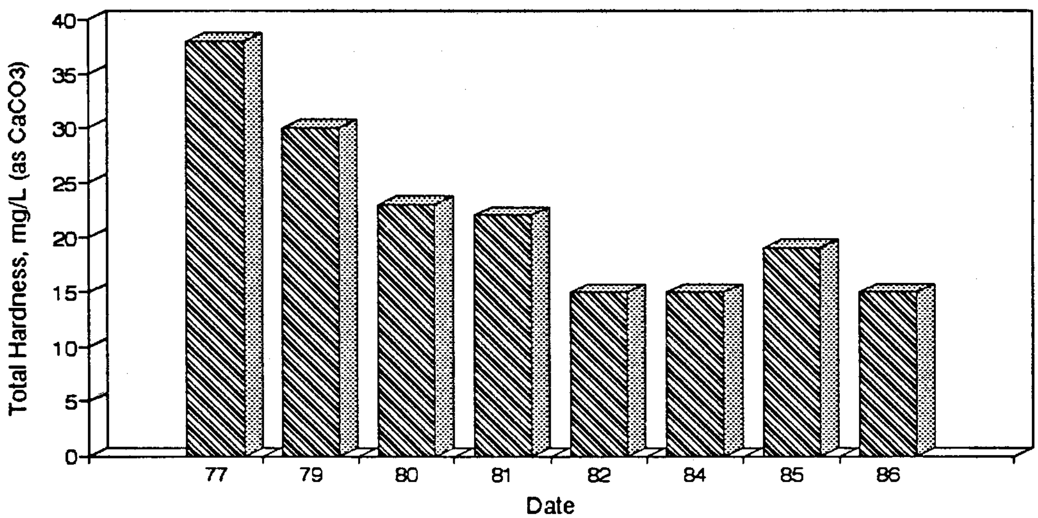

Figure A23. Graph of Total Hardness vs. Time for the Petit Site-Aug.

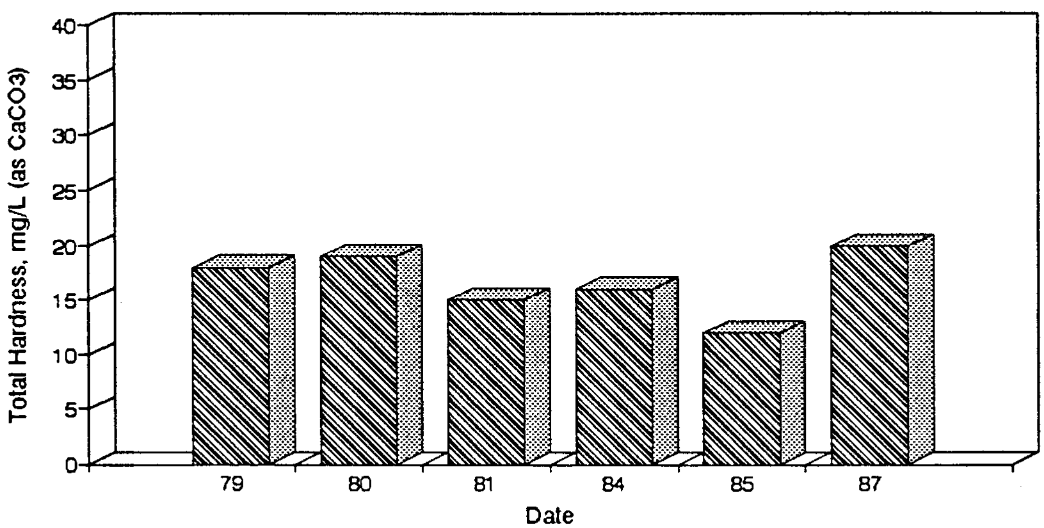

Figure A24. Graph of Total Hardness vs. Time for the Petit Site-Dec.

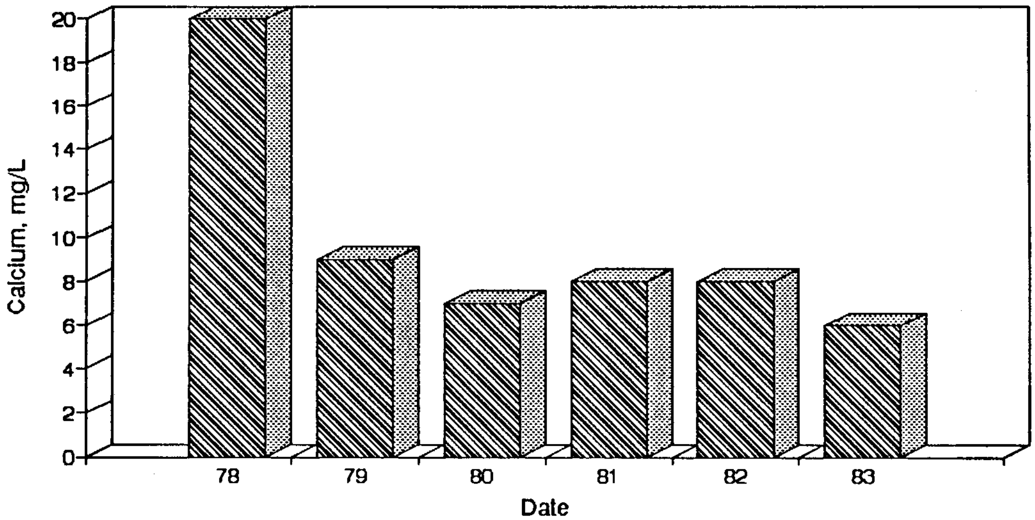

Figure A25. Graph of Calcium vs. Time for the Petit Site-May.

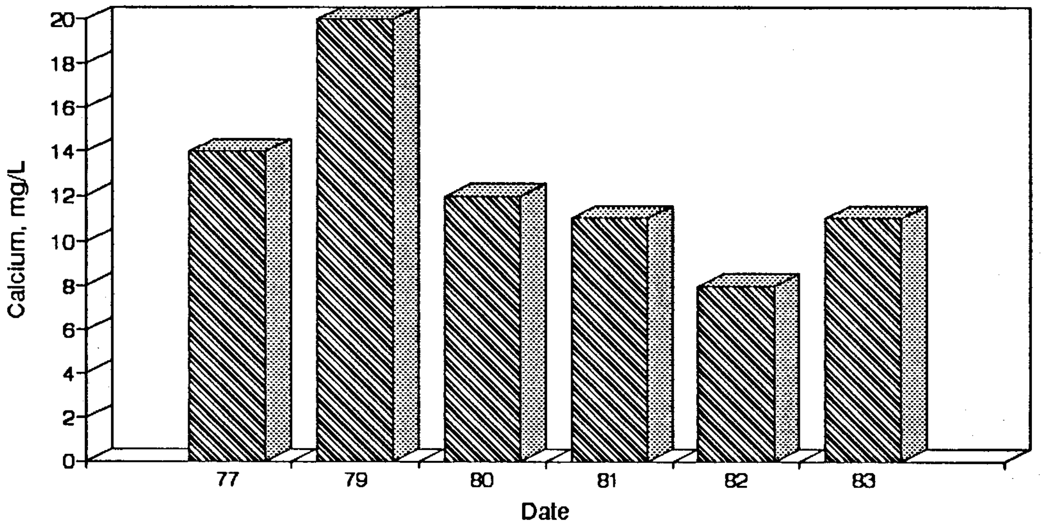

Figure A26. Graph of Calcium vs. Time for the Petit Site-Aug.

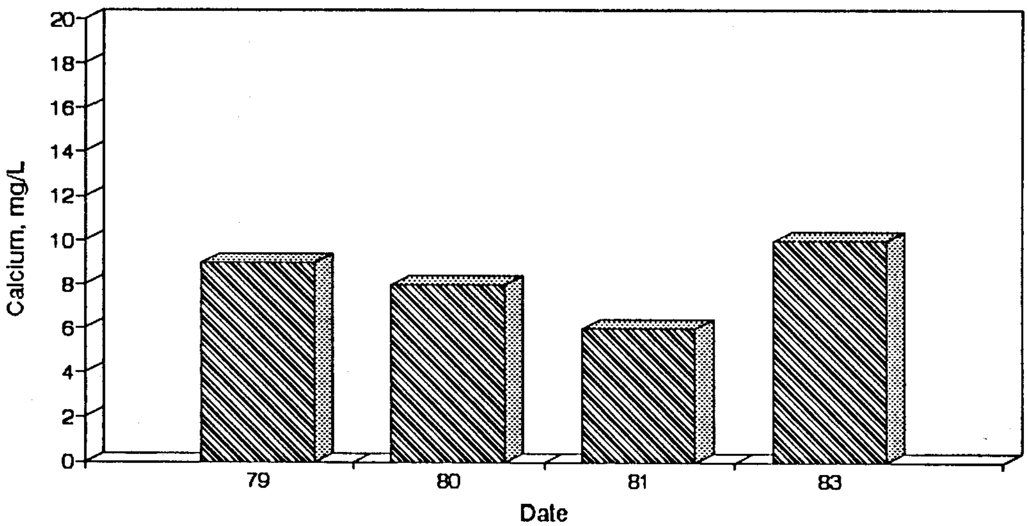

Figure A27. Graph of Calcium vs. Time for the Petit Site-Dec.

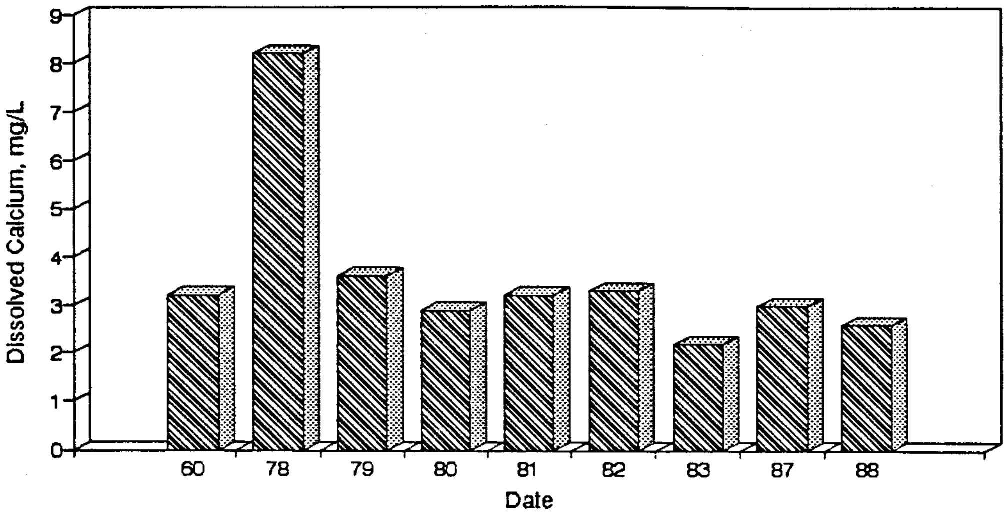

Figure A28. Graph of Dissolved Calcium vs. Time for the Petit Site-May.

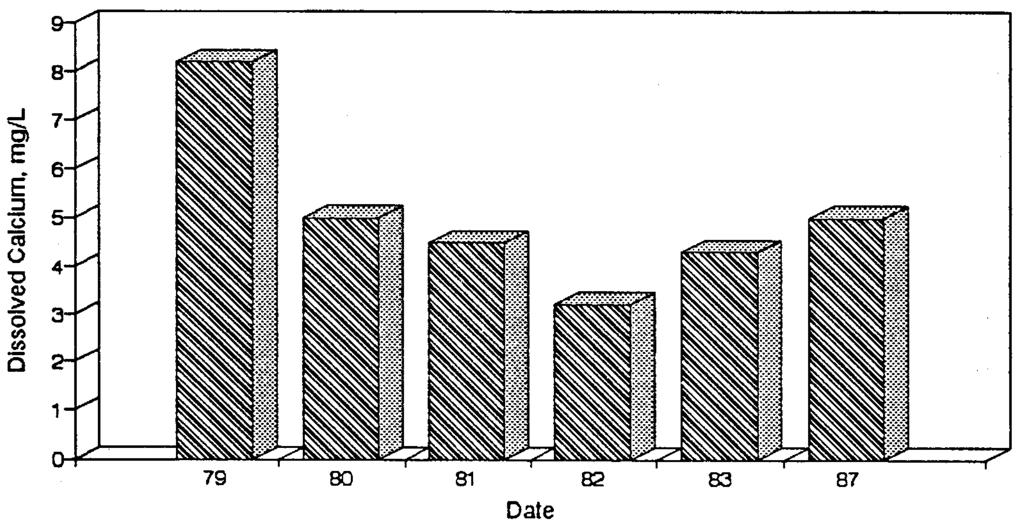

Figure A29. Graph of Dissolved Calcium vs. Time for the Petit Site-Aug.

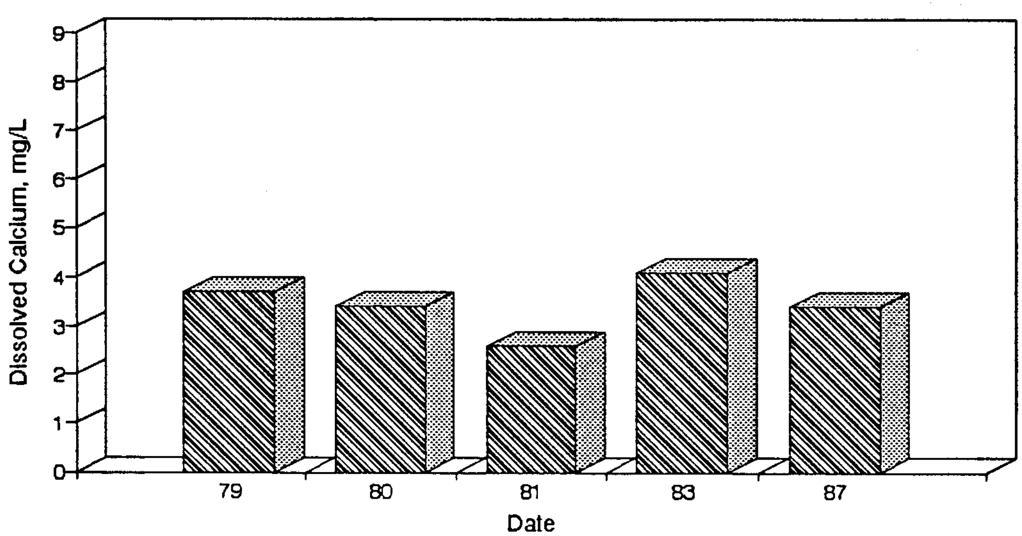

Figure A30. Graph of Dissolved Calcium vs. Time for the Petit Site-Dec.

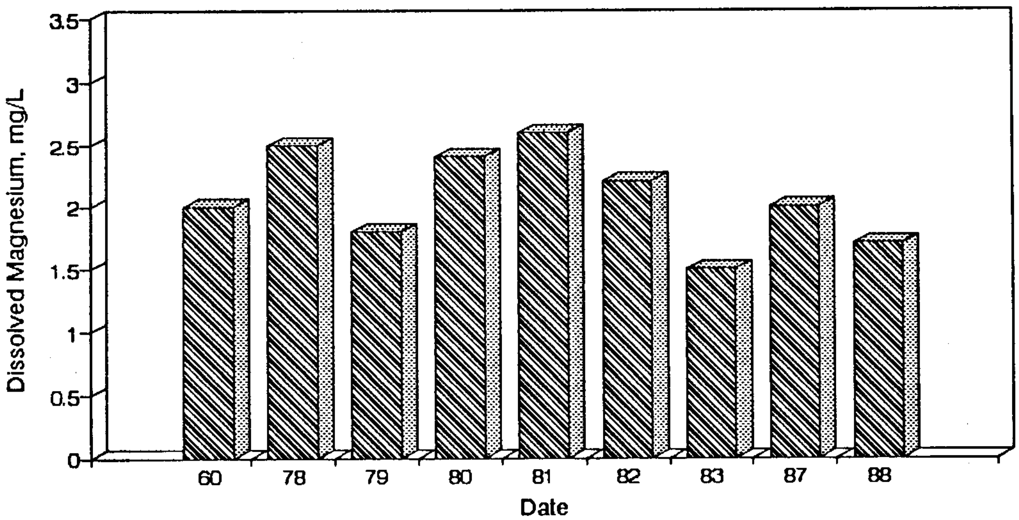

Figure A31. Graph of Dissolved Magnesium vs. Time for the Petit Site-May.

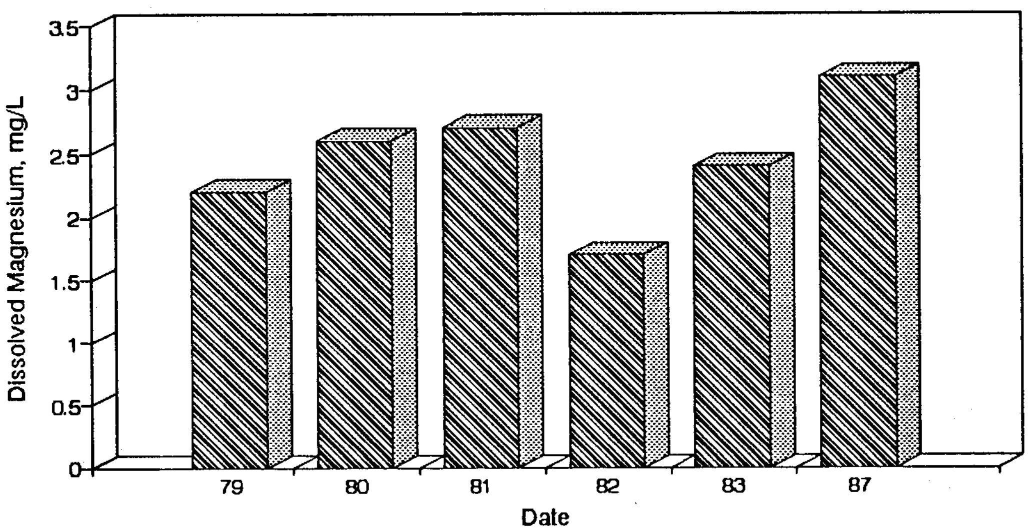

Figure A32. Graph of Dissolved Magnesium vs. Time for the Petit Site-Aug.

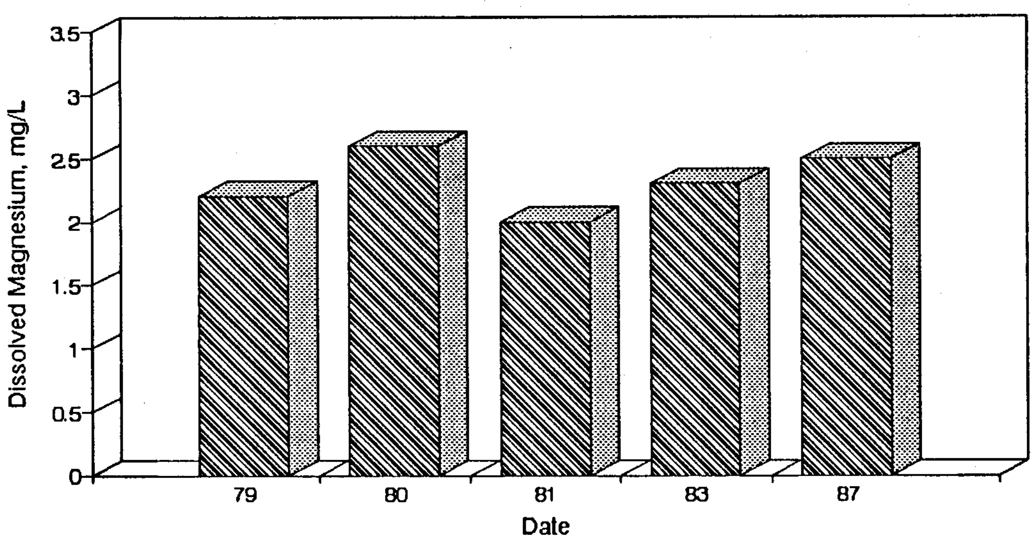

Figure A33. Graph of Dissolved Magnesium vs. Time for the Petit Site-Dec.

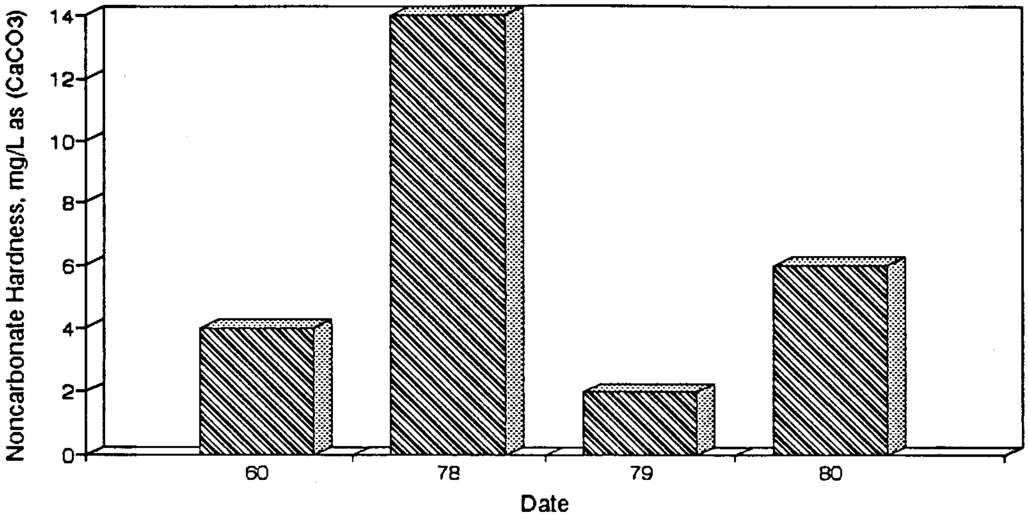

Figure A34. Graph of Noncarbonate Hardness vs. Time for the Petit Site-May.

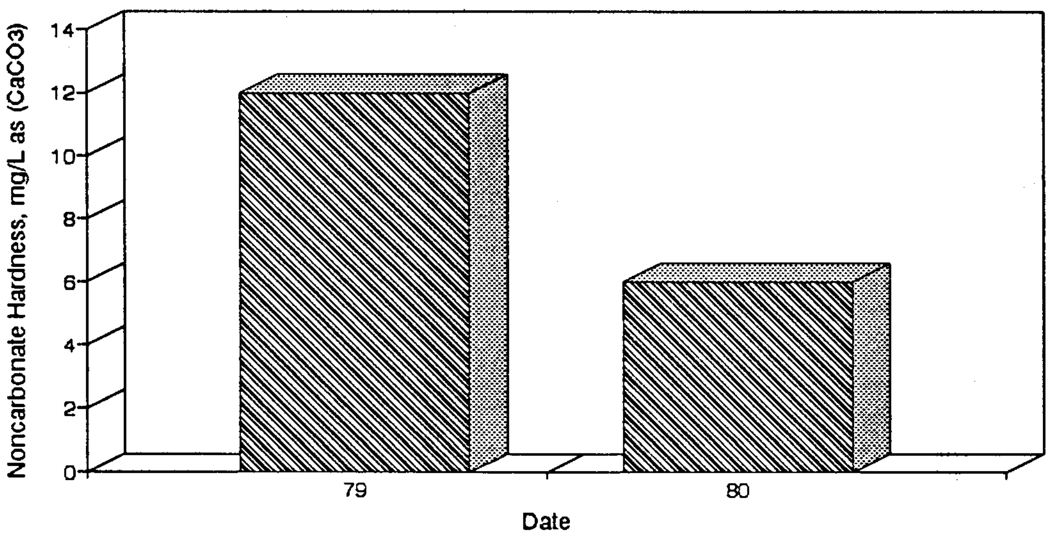

Figure A35. Graph of Noncarbonate Hardness vs. Time for the Petit Site-Aug.

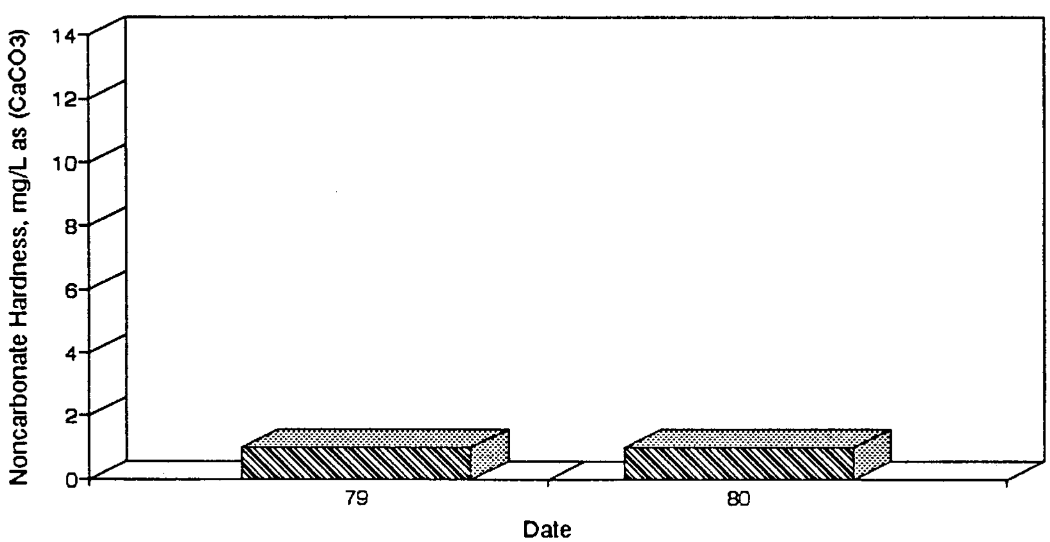

Figure A36. Graph of Noncarbonate Hardness vs. Time for the Petit Site-Dec.

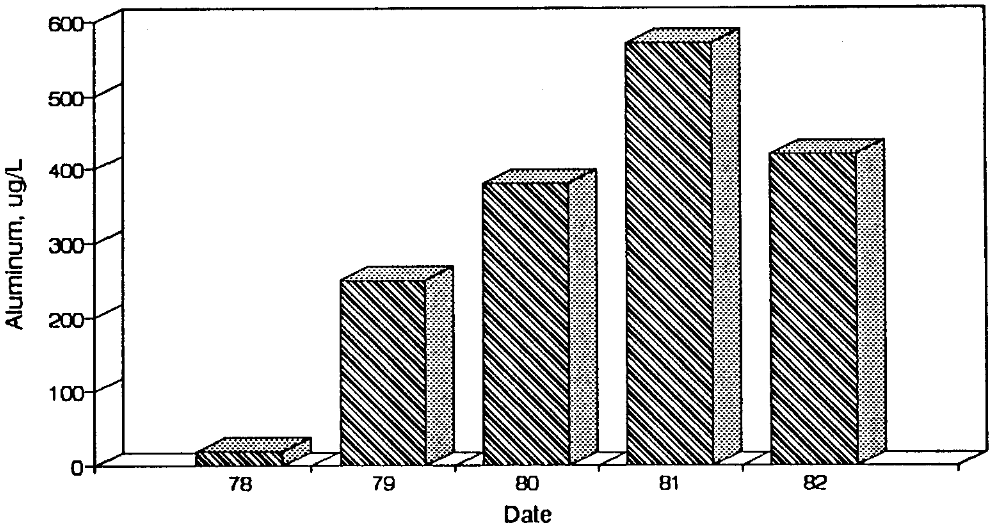

Figure A37. Graph of Aluminum vs. Time for the Petit Site-Aug.

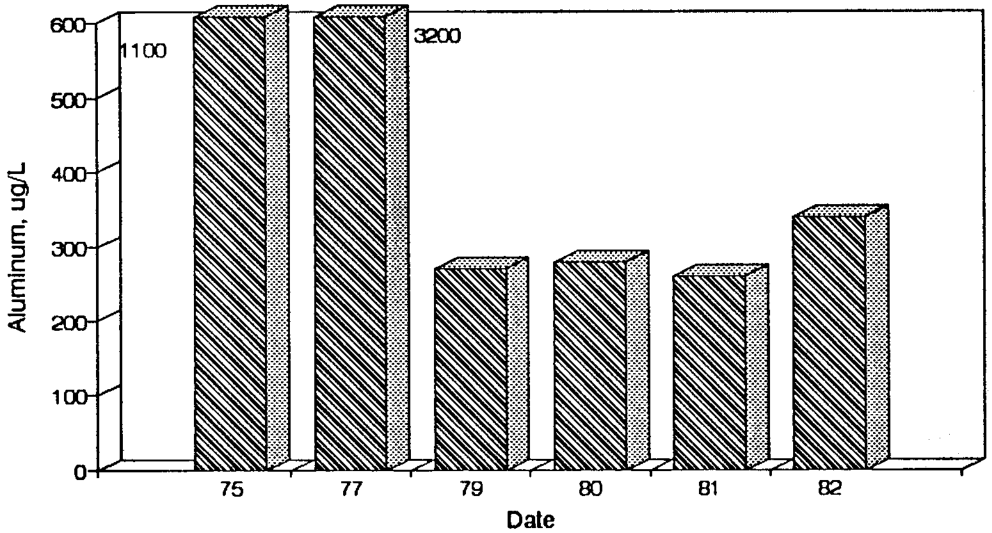

Figure A38. Graph of Aluminum vs. Time for the Petit Site-Aug.

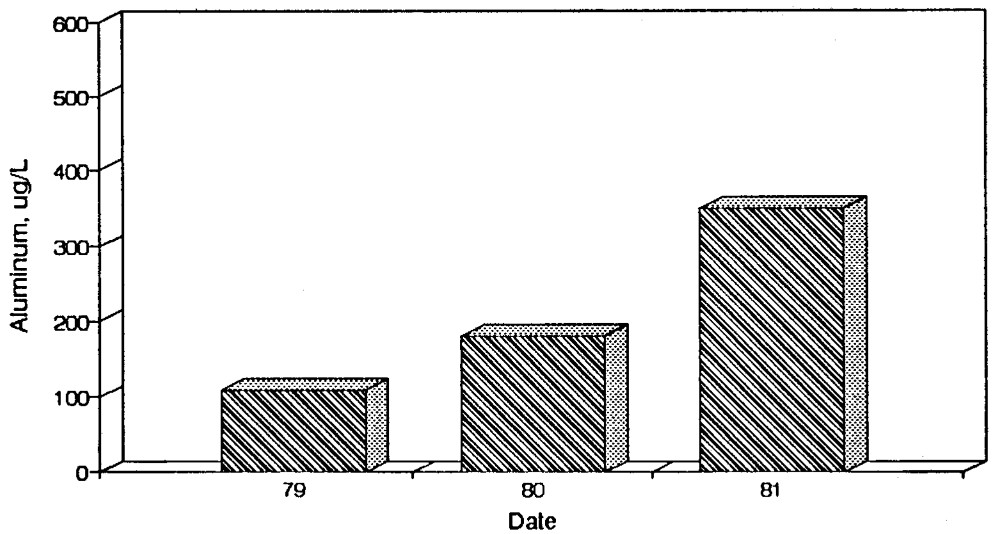

Figure A39. Graph of Aluminum vs. Time for the Petit Site-Dec.

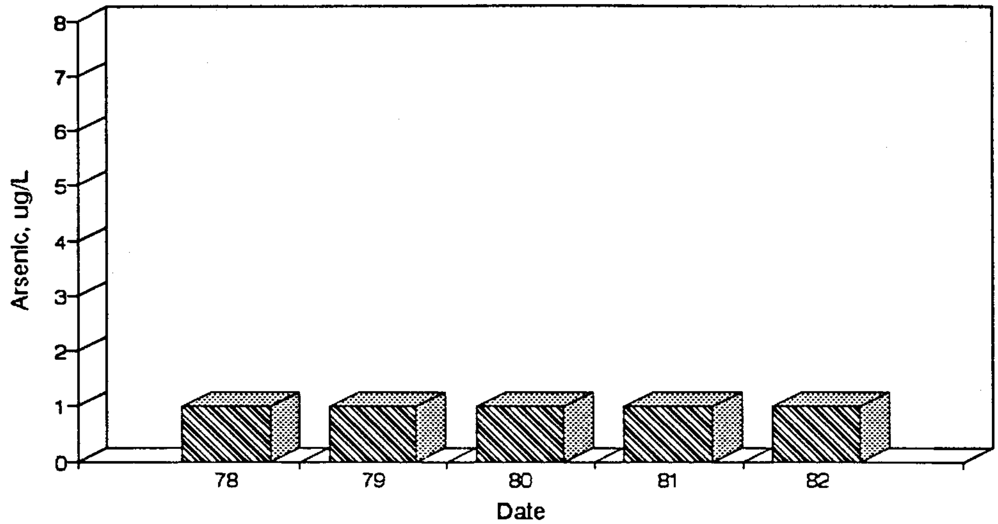

Figure A40. Graph of Arsenic vs. Time for the Petit Site-May.

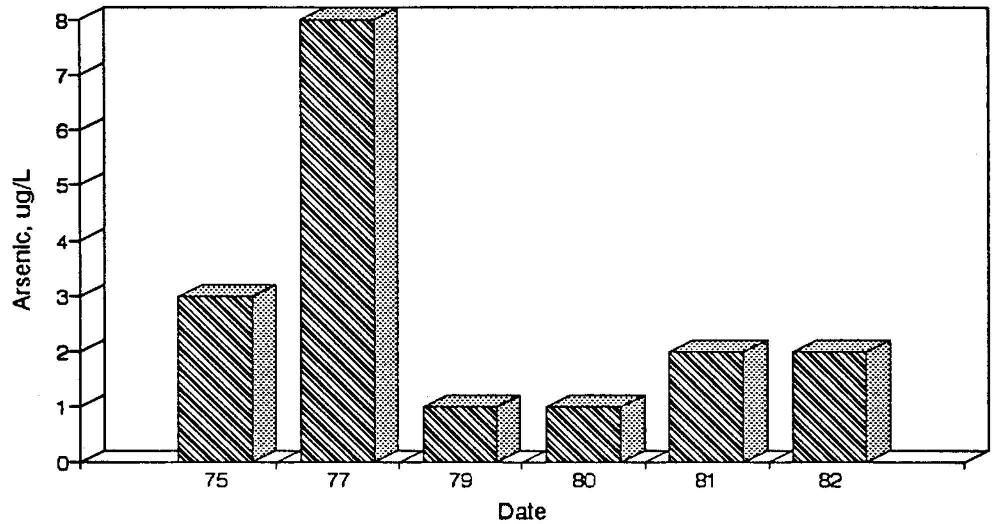

Figure A41. Graph of Arsenic vs. Time for the Petit Site-Aug.

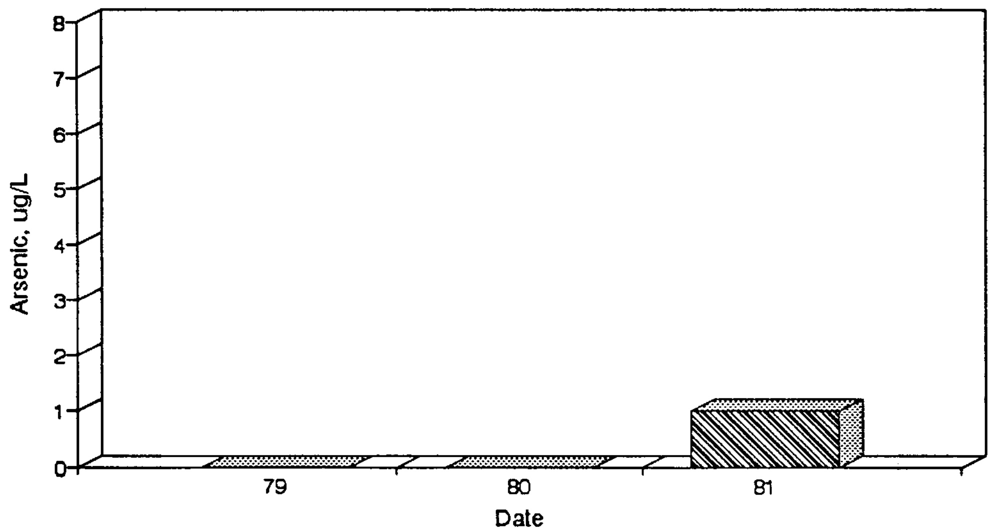

Figure A42. Graph of Arsenic vs. Time for the Petit Site-Dec.

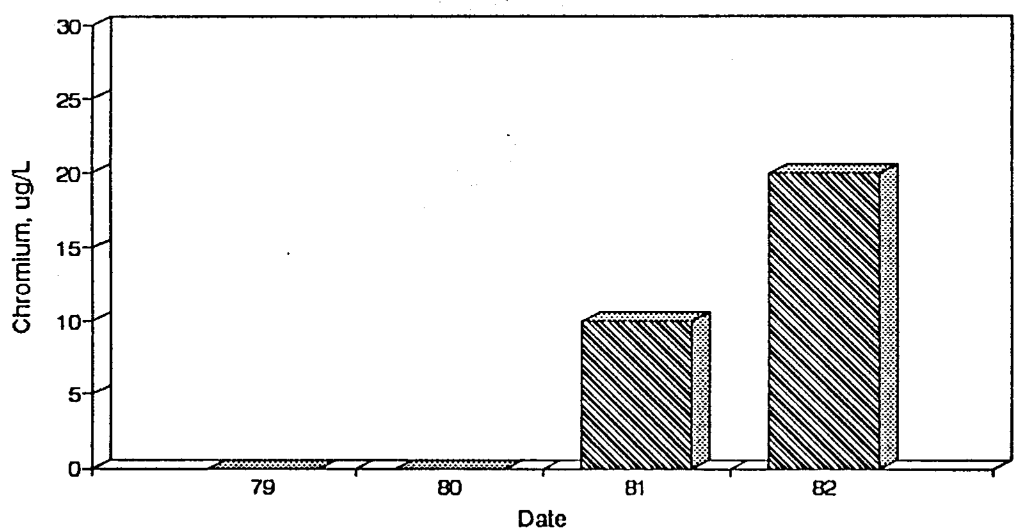

Figure A43. Graph of Chromium vs. Time for the Petit Site-May.

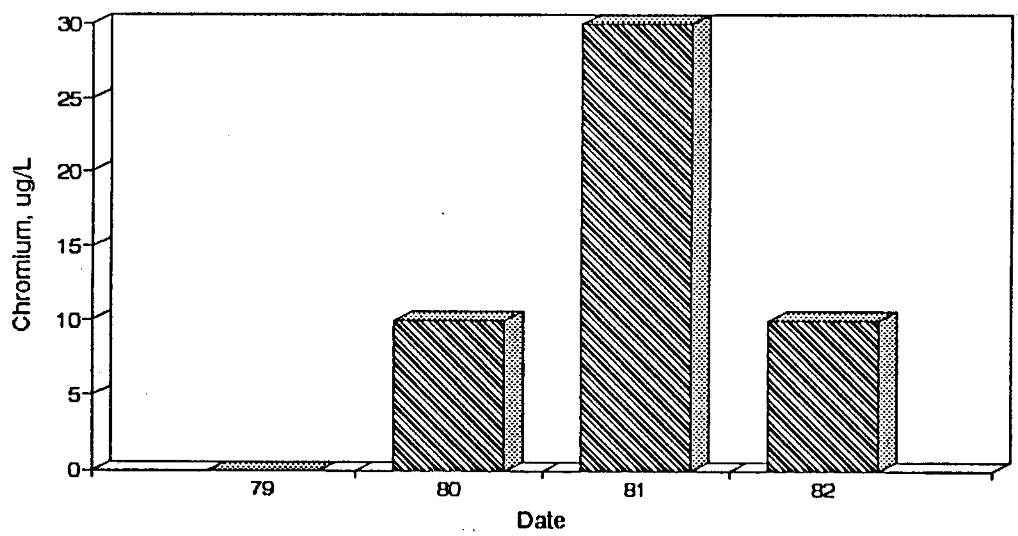

Figure A44. Graph of Chromium vs. Time for the Petit Site-Aug.

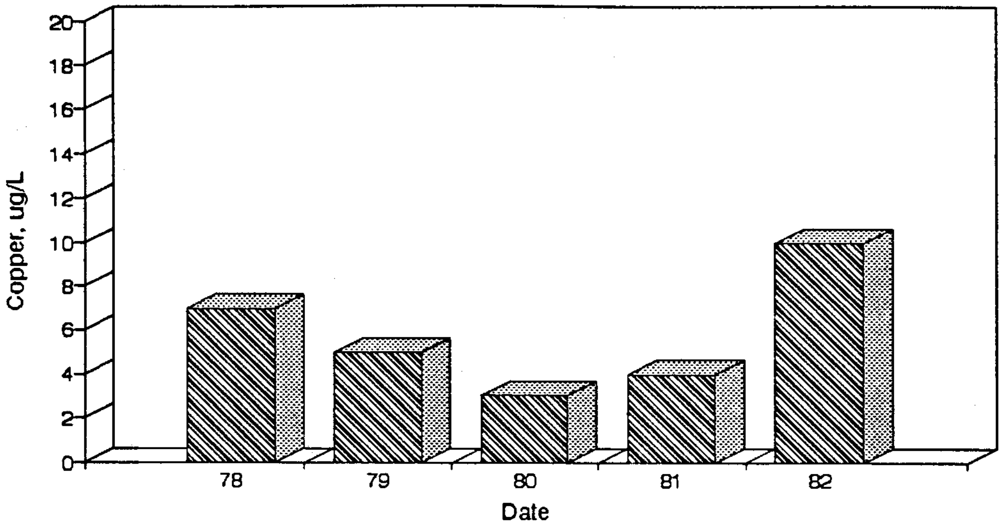

Figure A45. Graph of Copper vs. time for the Petit Site-May.

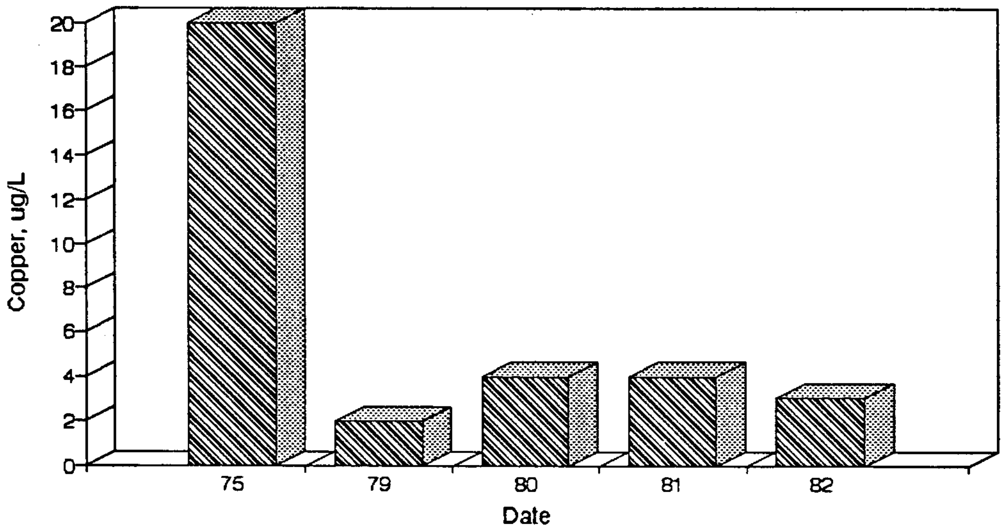

Figure A46. Graph of Copper vs. time for the Petit Site-Aug.

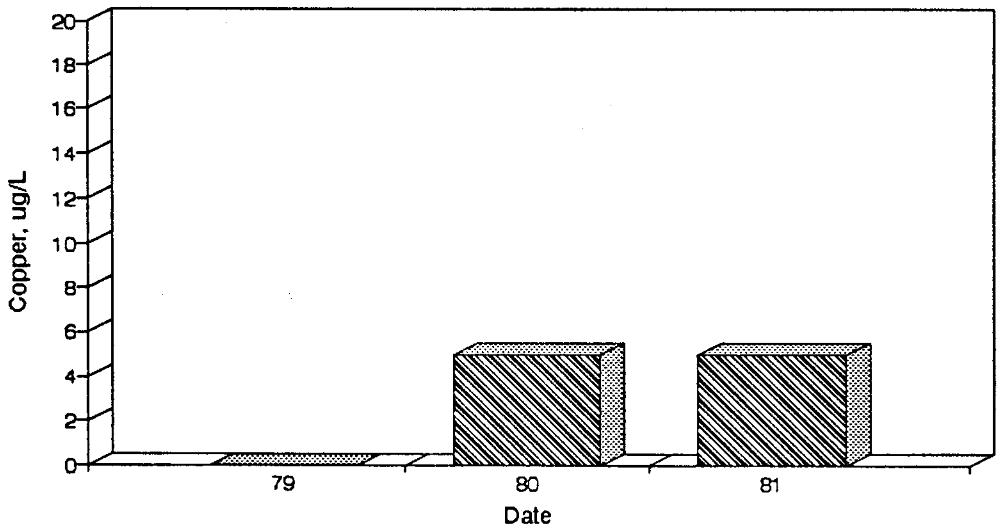

Figure A47. Graph of Copper vs. time for the Petit Site-Dec.

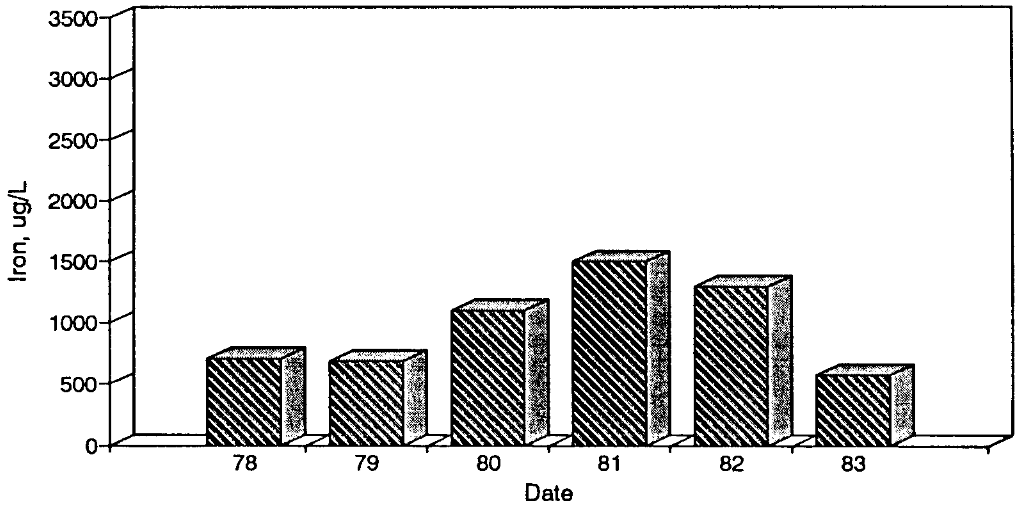

Figure A48. Graph of Iron vs. Time for the Petit Site-May.

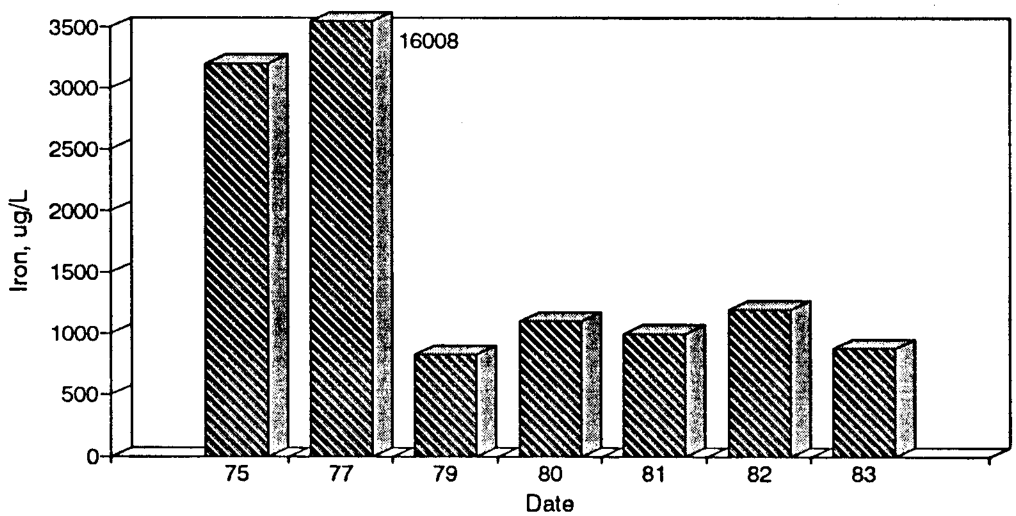

Figure A49. Graph of Iron vs. Time for the Petit Site-Aug.

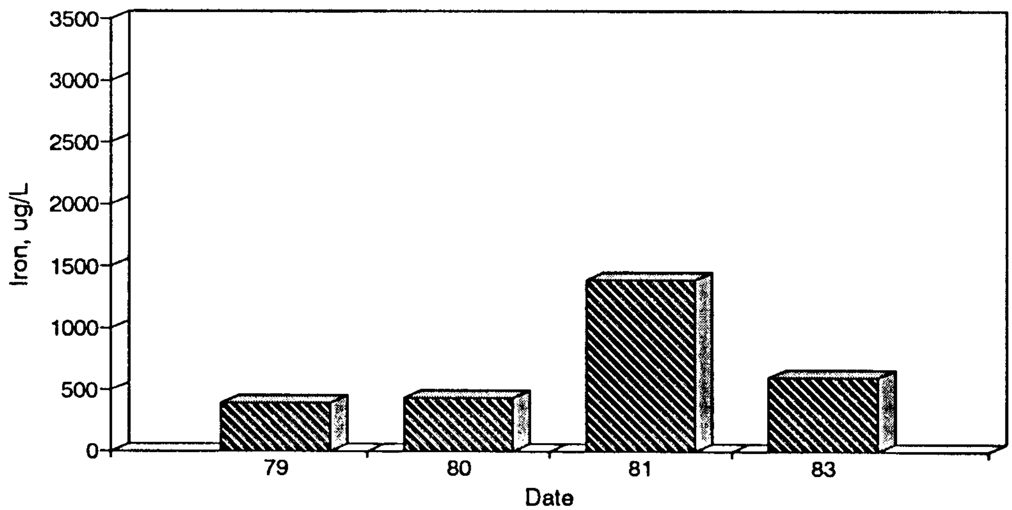

Figure A50. Graph of Iron vs. Time for the Petit Site-Dec.

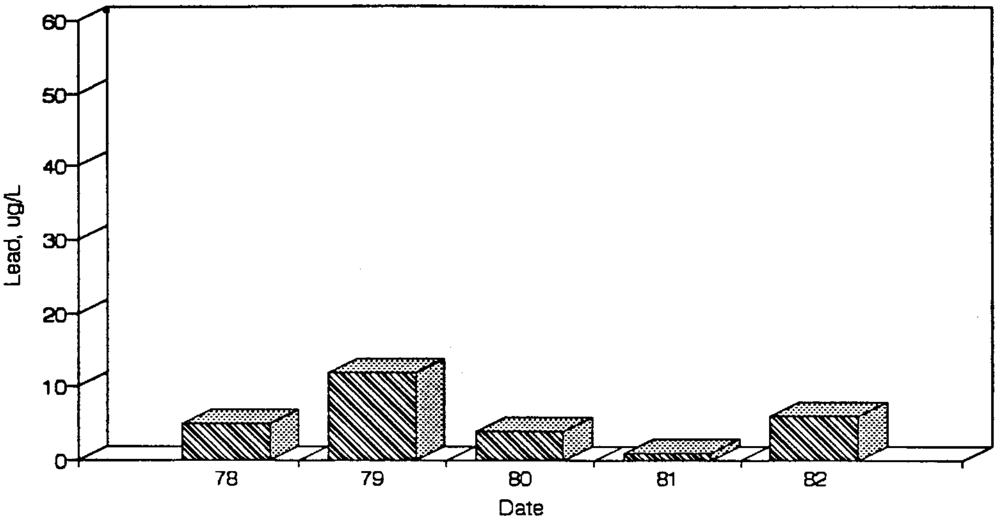

Figure A51. Graph of Lead vs. Time for the Petit Site-May.

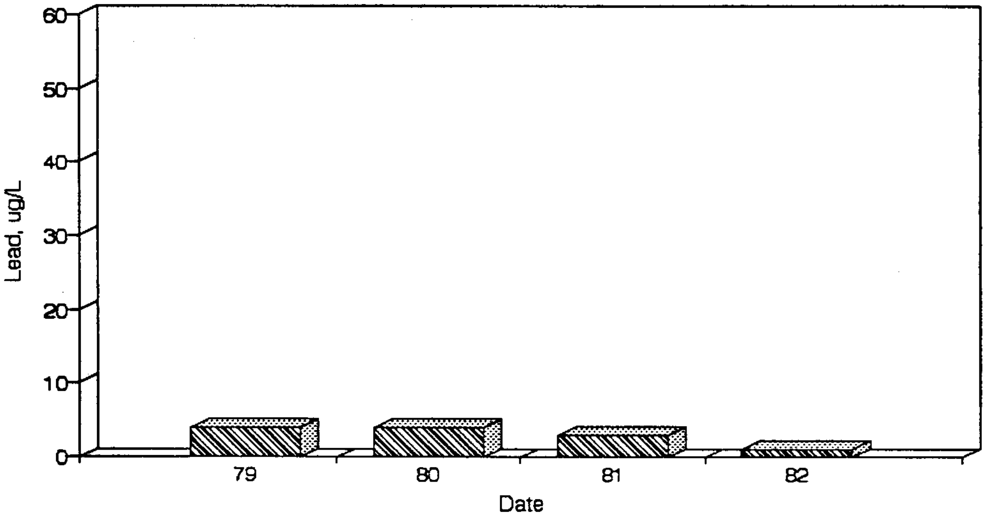

Figure A52. Graph of Lead vs. Time for the Petit Site-Aug.

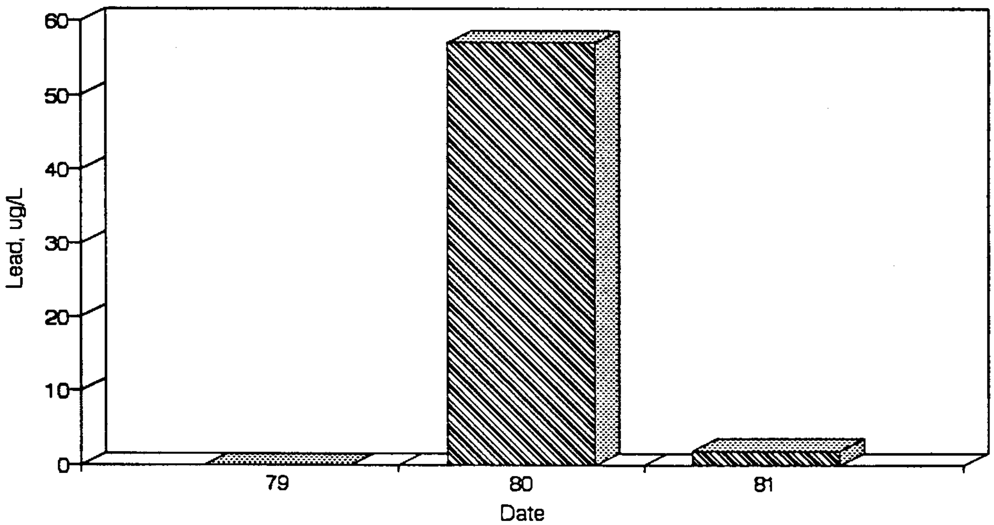

Figure A53. Graph of Lead vs. Time for the Petit Site-Dec.

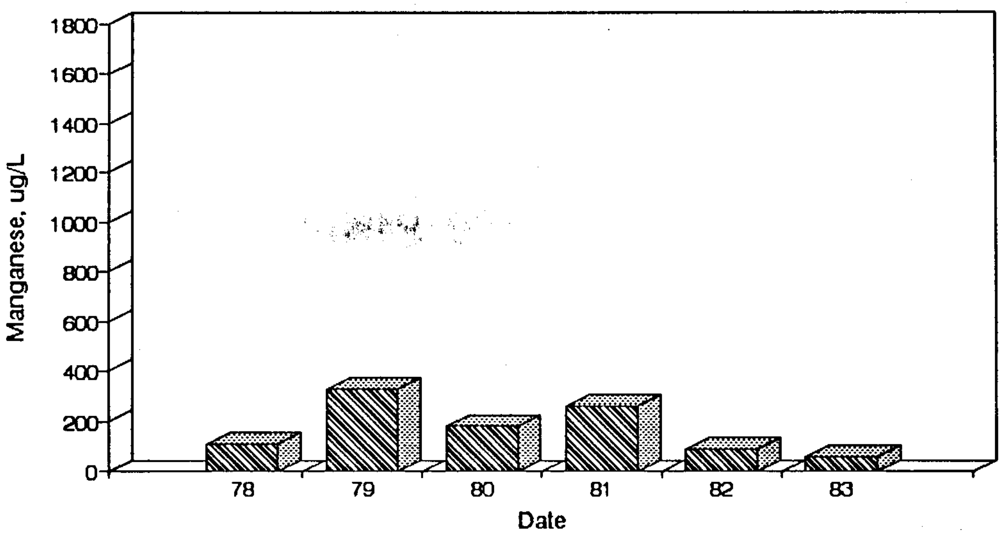

Figure A54. Graph of Manganese vs. Time for the Petit Site-May.

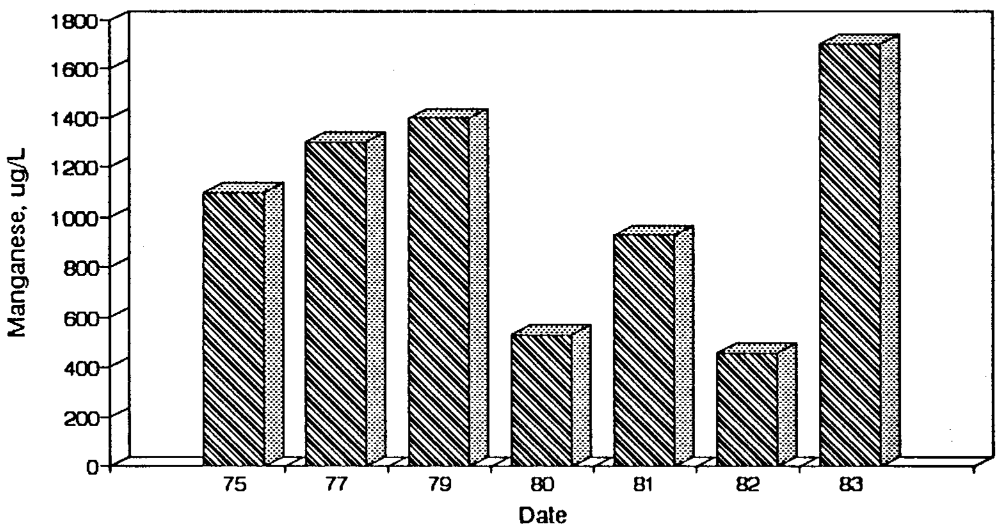

Figure A55. Graph of Manganese vs. Time for the Petit Site-Aug.

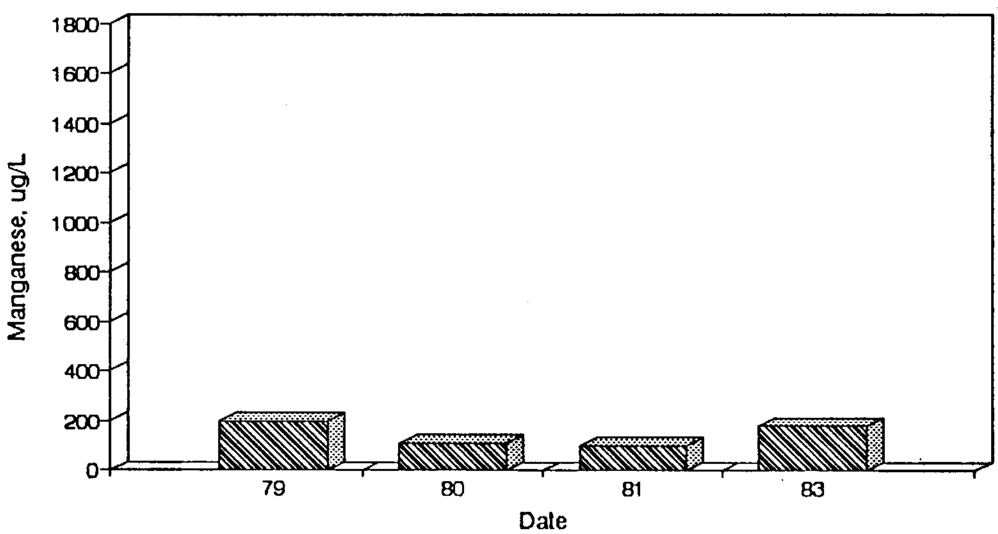

Figure A56. Graph of Manganese vs. Time for the Petit Site-Dec.

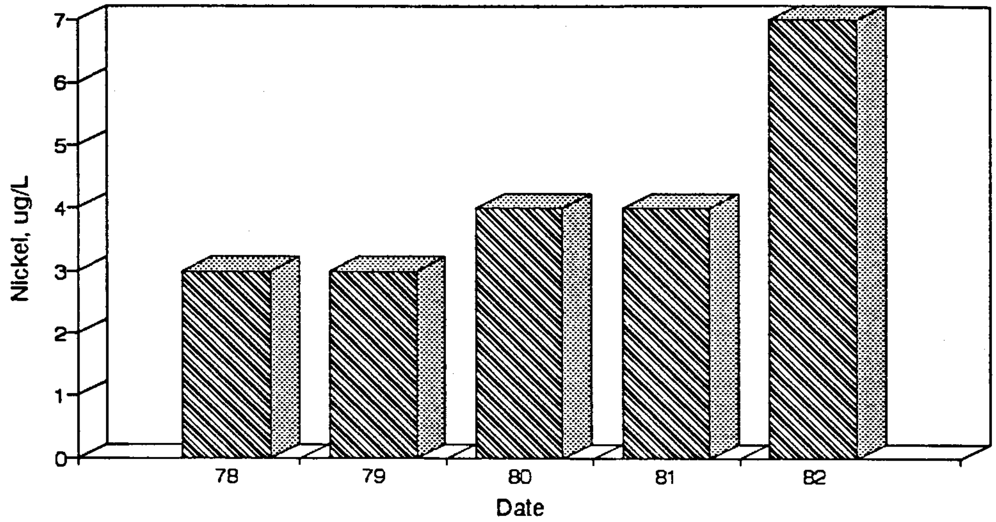

Figure A57. Graph of Nickel vs. Time for the Petit Site-May.

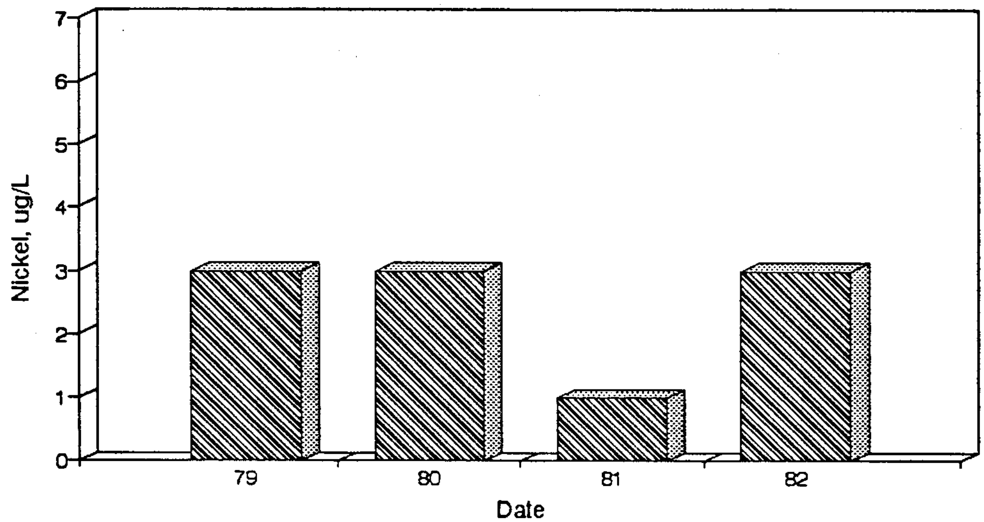

Figure A58. Graph of Nickel vs. Time for the Petit Site-Aug.

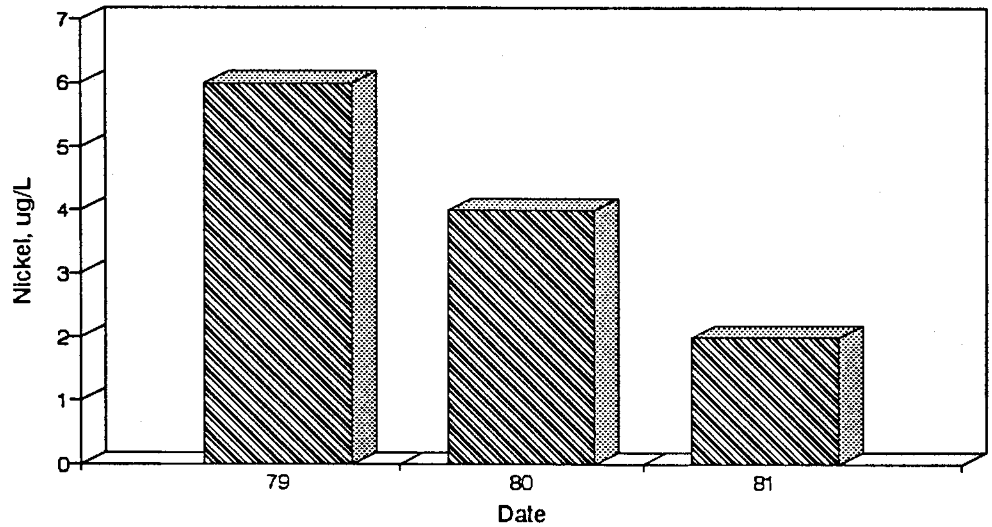

Figure A59. Graph of Nickel vs. Time for the Petit Site-Dec.

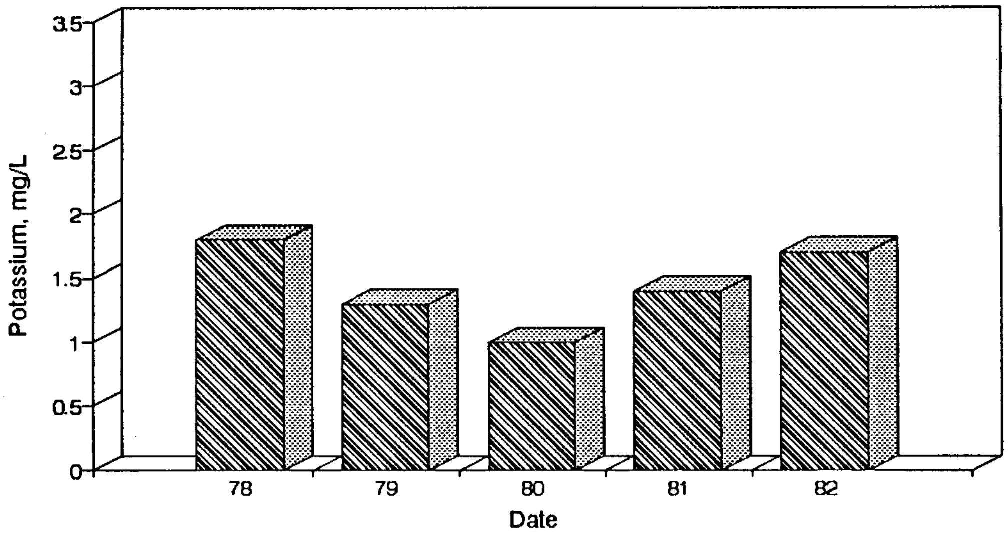

Figure A60. Graph of Potassium vs. Time for the Petit Site-May.

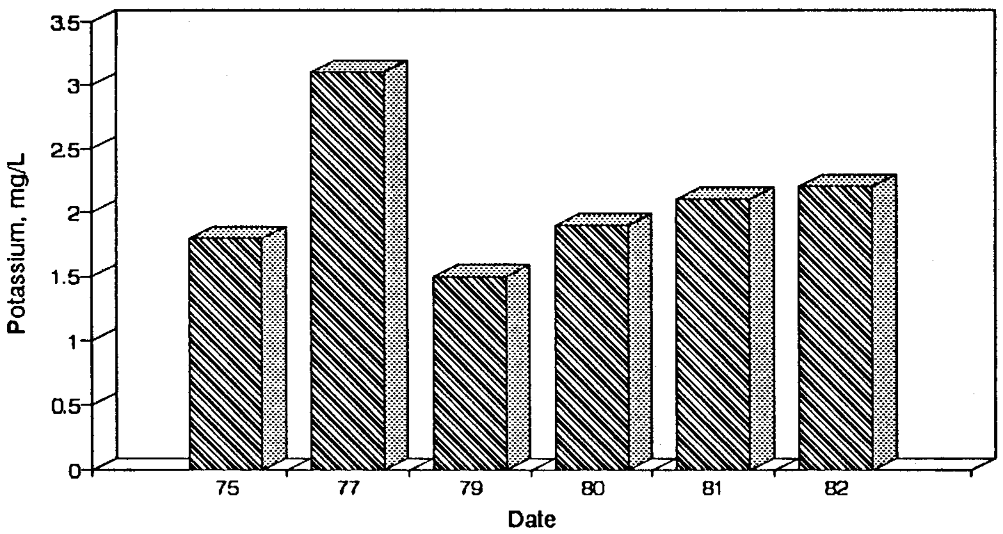

Figure A61. Graph of Potassium vs. Time for the Petit Site-Aug.

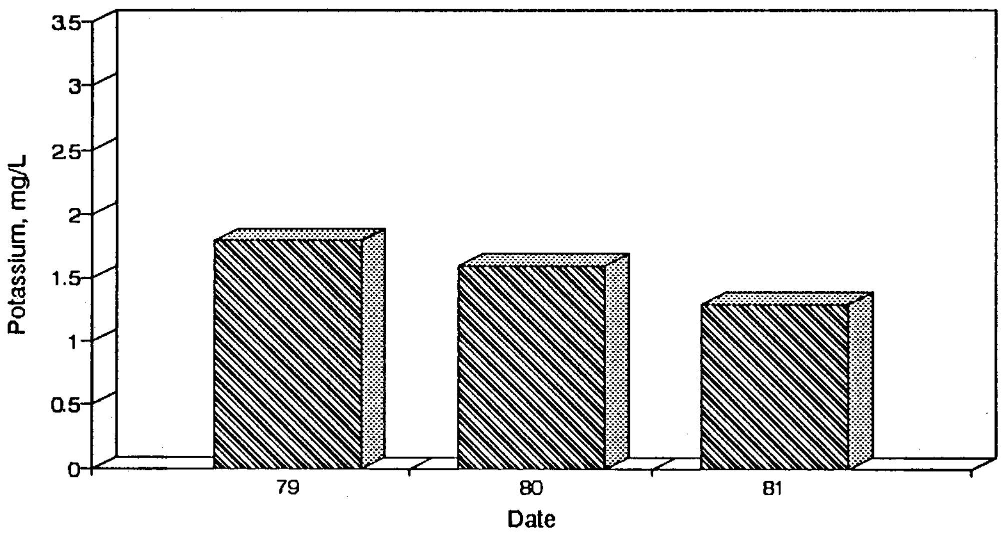

Figure A62. Graph of Potassium vs. Time for the Petit Site-Dec.

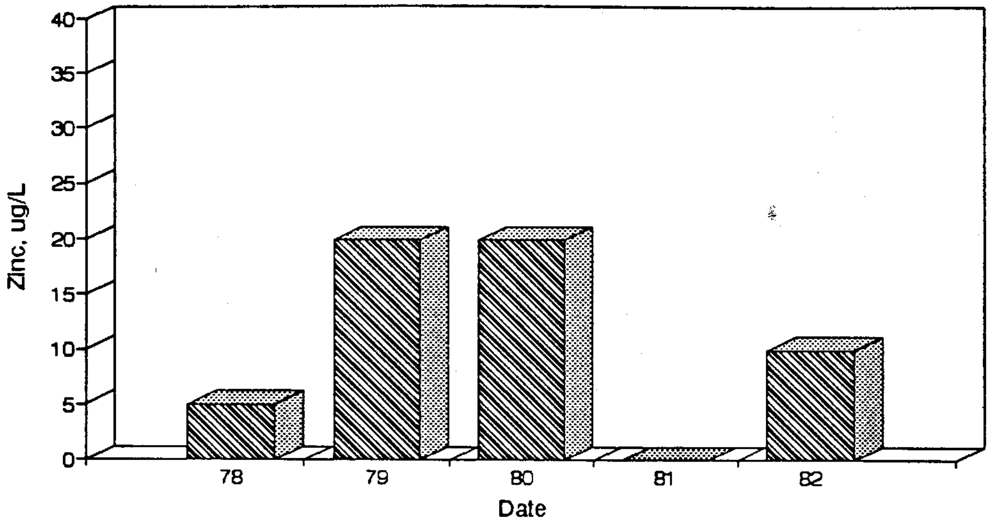

Figure A63. Graph of Zinc vs. Time for the Petit Site-May.

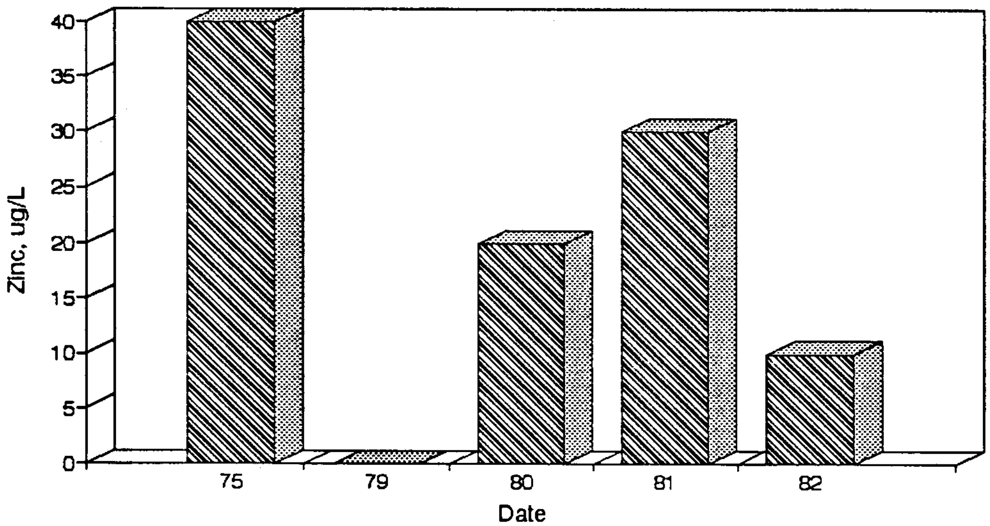

Figure A64. Graph of Zinc vs. Time for the Petit Site-Aug.

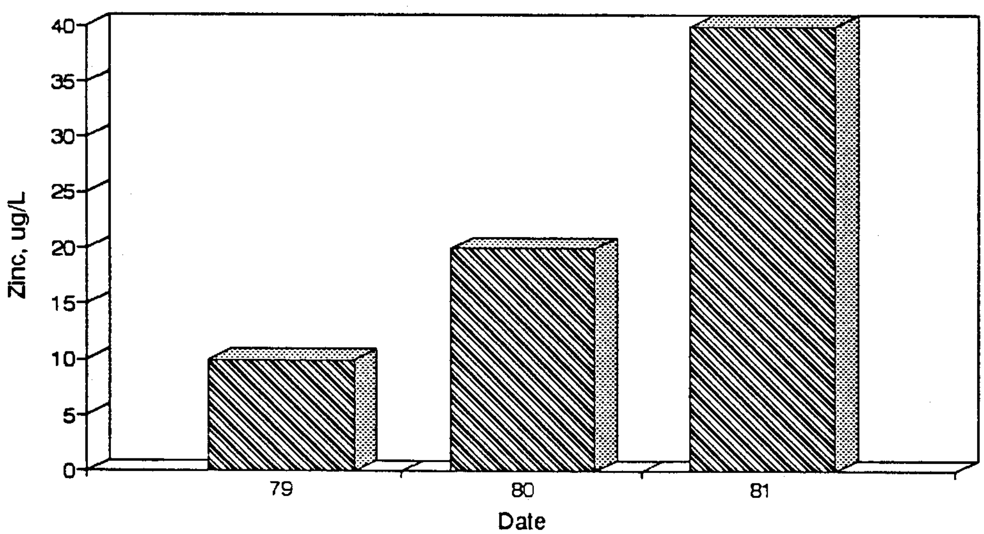

Figure A65. Graph of Zinc vs. Time for the Petit Site-Dec.

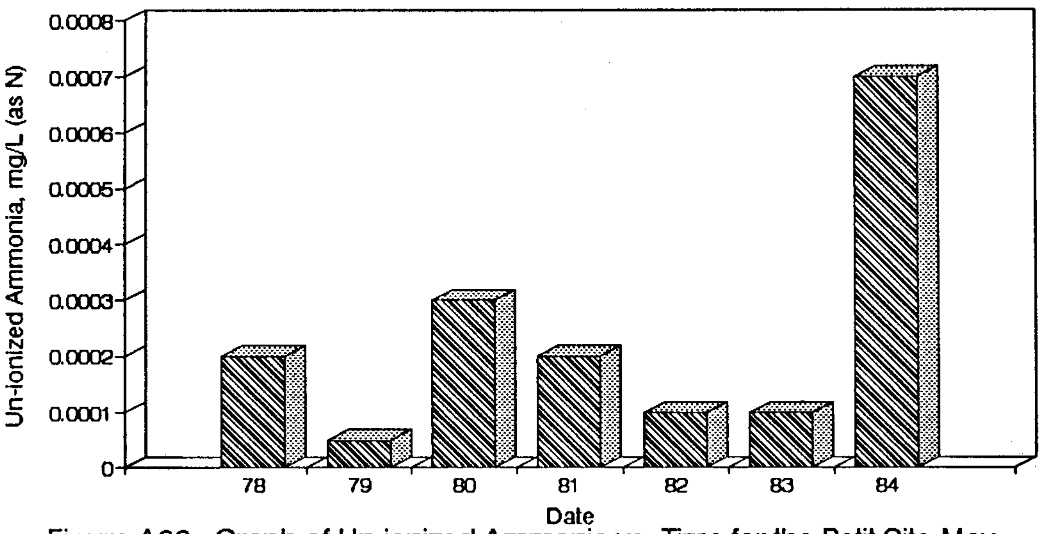

Figure A66. Graph of Un-ionized Ammonia vs. Time for the Petit Site-May.

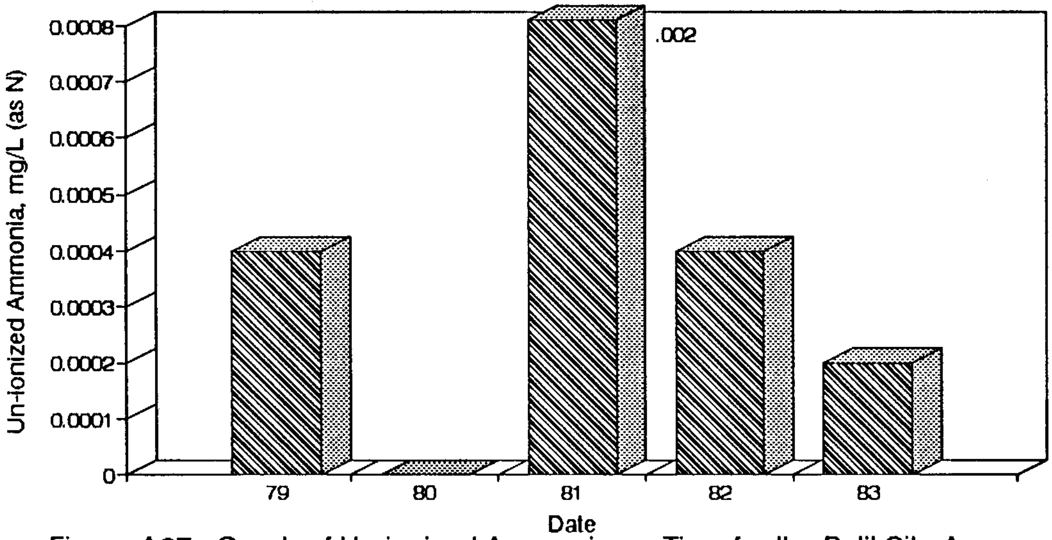

Figure A67. Graph of Un-ionized Ammonia vs. Time for the Petit Site-Aug.

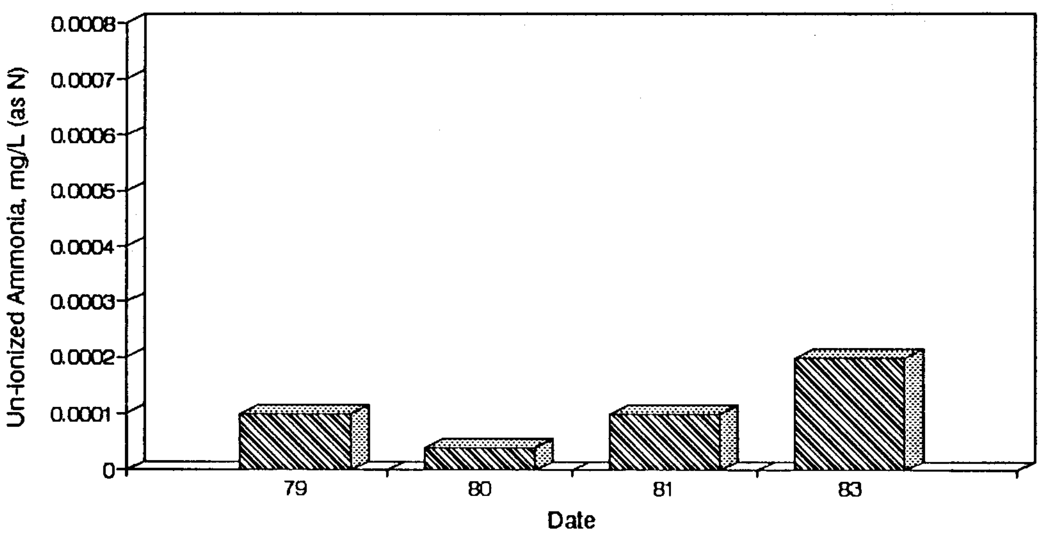

Figure A68. Graph of Un-ionized Ammonia vs. Time for the Petit Site-Dec.

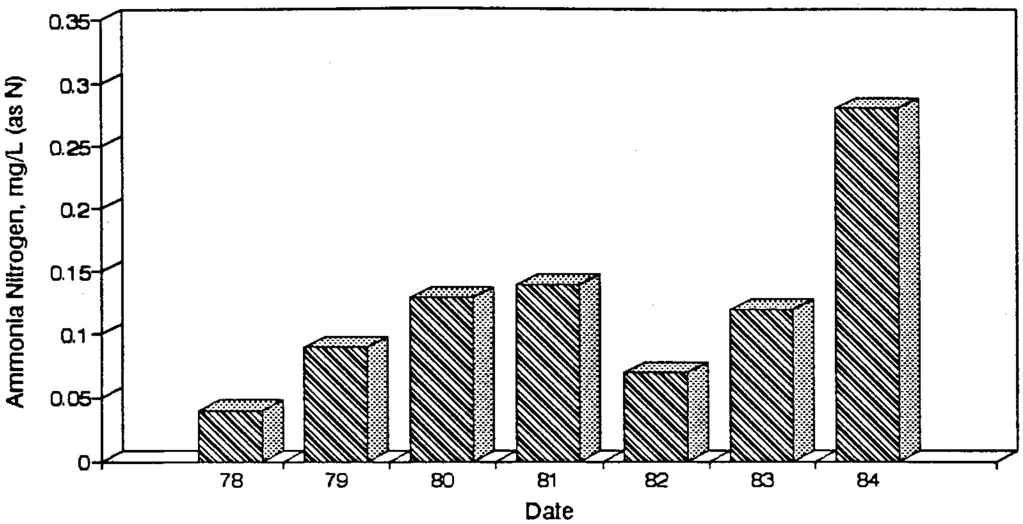

Figure A69. Graph of Ammonia Nitrogen vs. Time for the Petit Site-May.

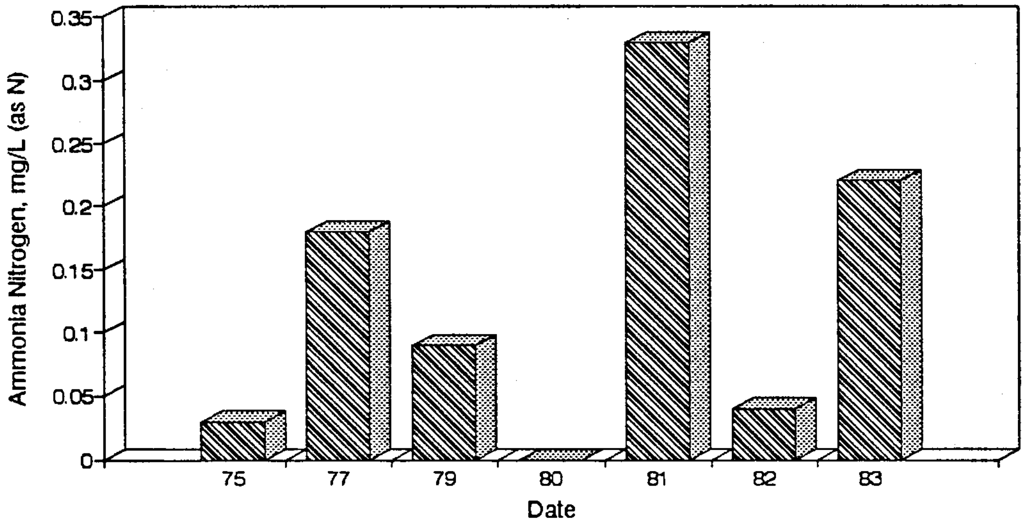

Figure A70. Graph of Ammonia Nitrogen vs. Time for the Petit Site-Aug.

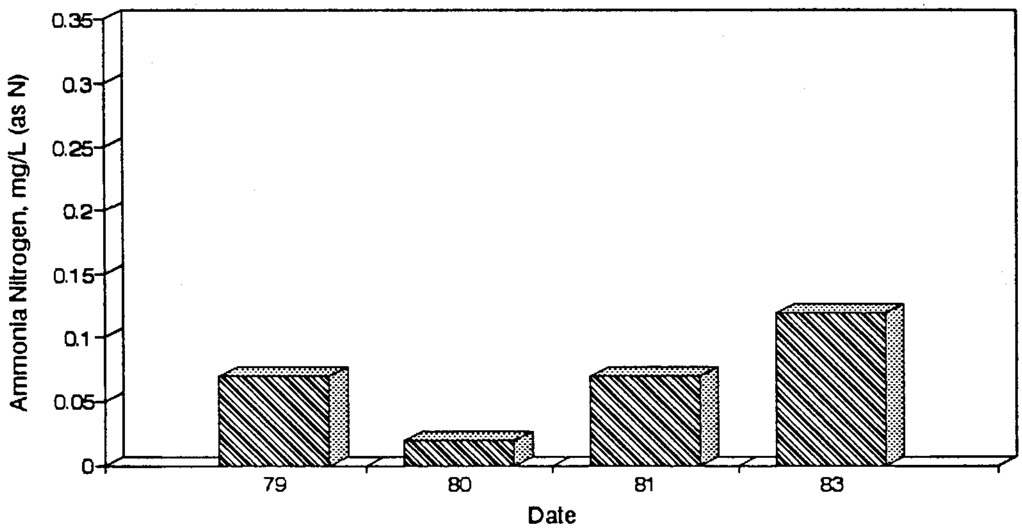

Figure A71. Graph of Ammonia Nitrogen vs. Time for the Petit Site-Dec.

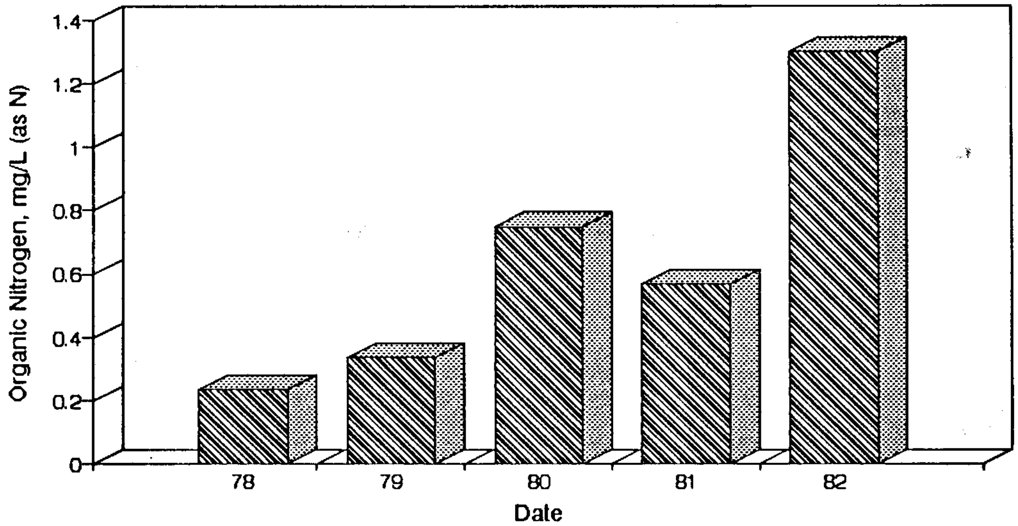

Figure A72. Graph of Organic Nitrogen vs. Time for the Petit Site-May.

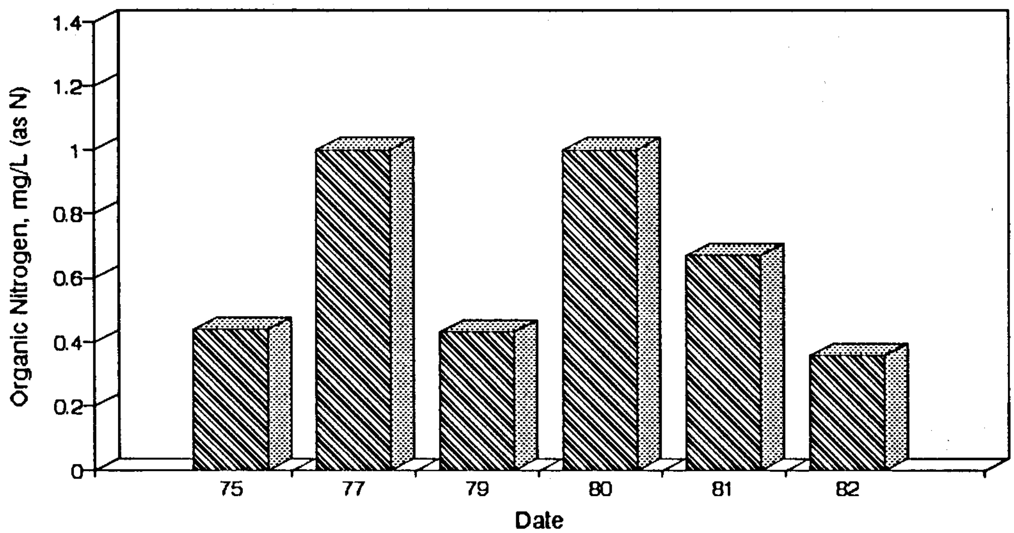

Figure A73. Graph of Organic Nitrogen vs. Time for the Petit Site-Aug.

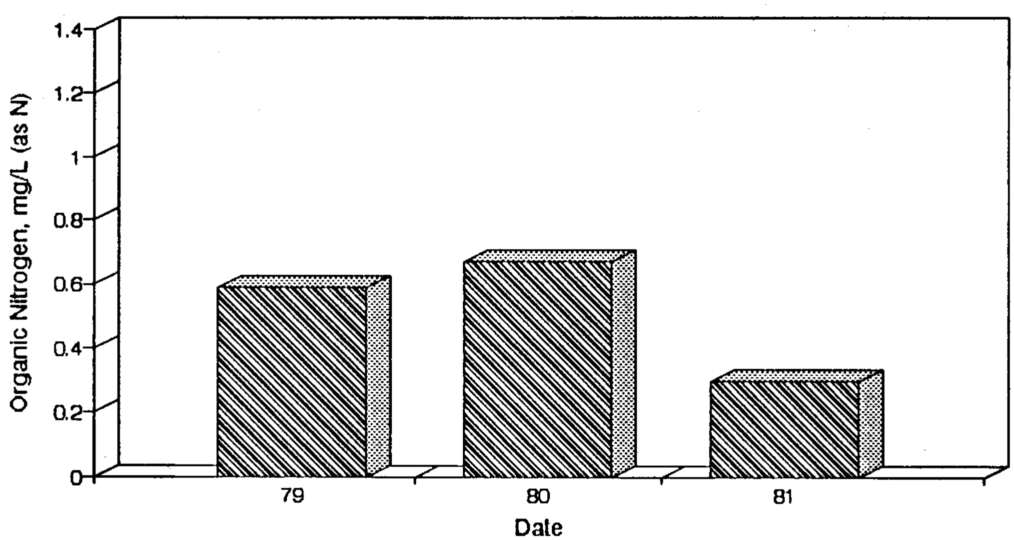

Figure A74. Graph of Organic Nitrogen vs. Time for the Petit Site-Dec.

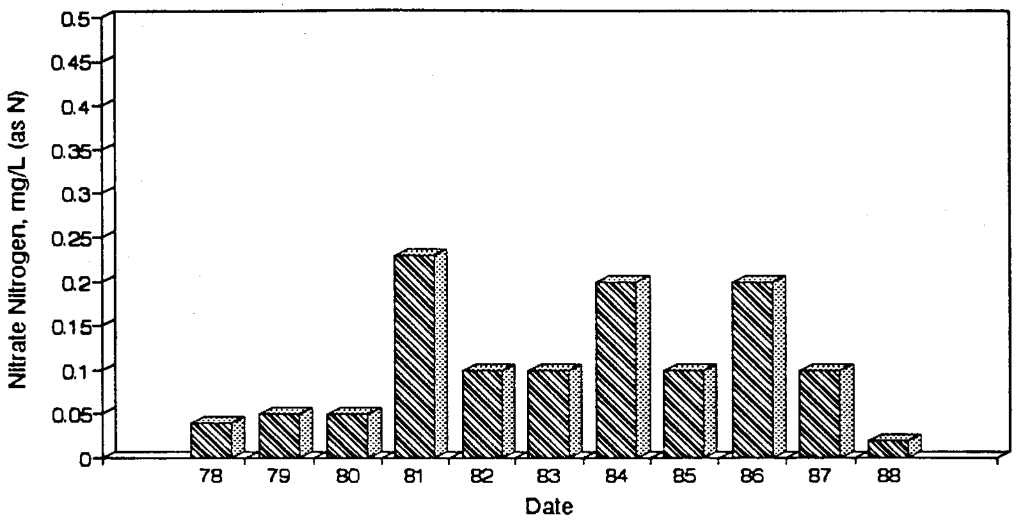

Figure A75. Graph of Nitrate Nitrogen vs. Time for the Petit Site-May.

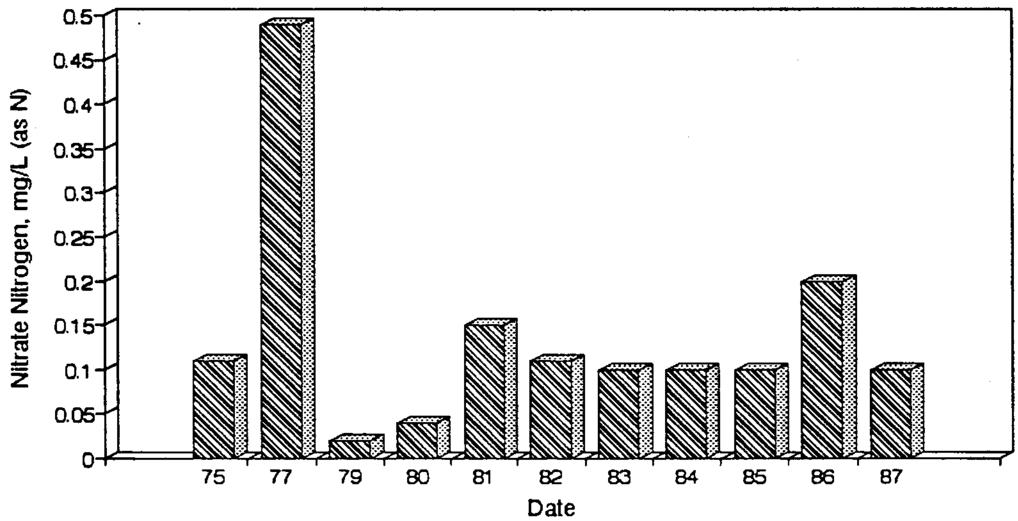

Figure A76. Graph of Nitrate Nitrogen vs. Time for the Petit Site-Aug.

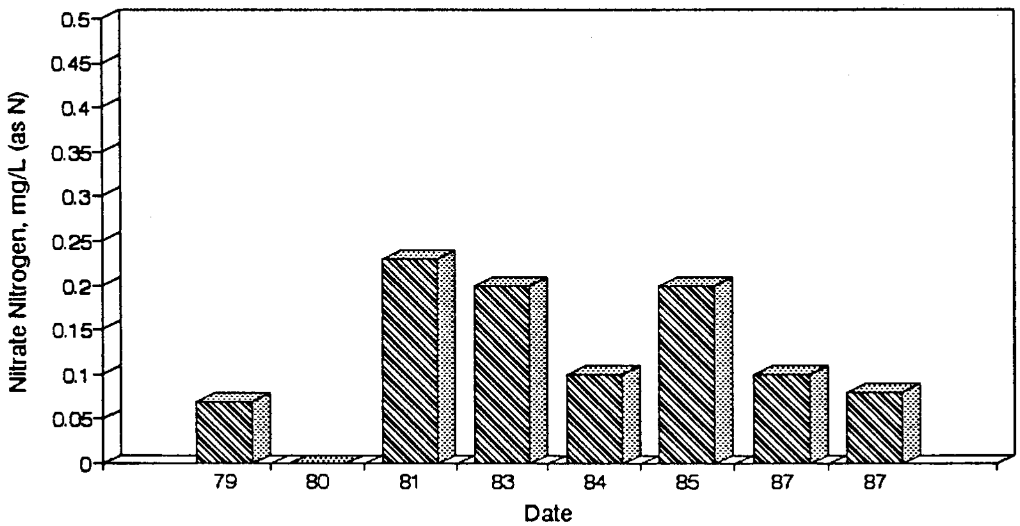

Figure A77. Graph of Nitrate Nitrogen vs. Time for the Petit Site-Dec.

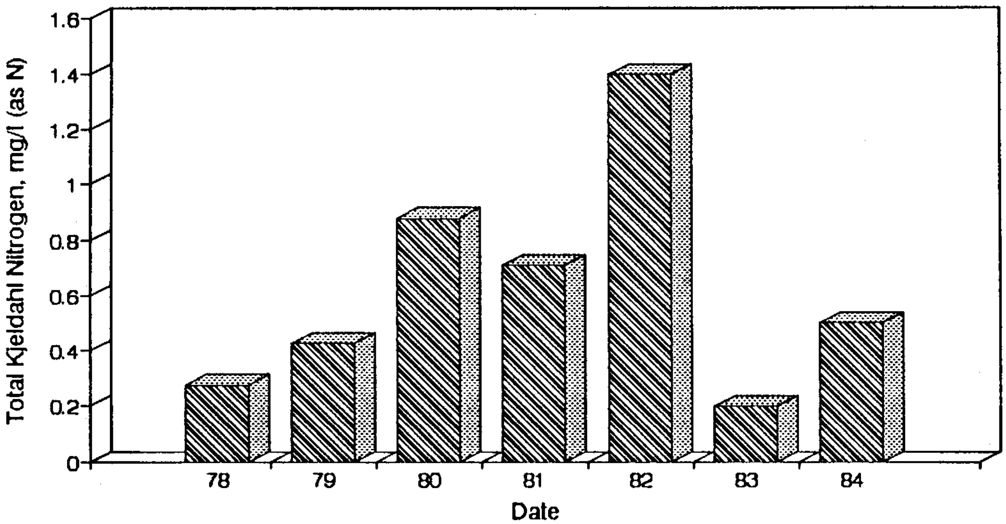

Figure A78. Graph of Total Kjeldahl Nitrogen vs. Time for the Petit Site-May.

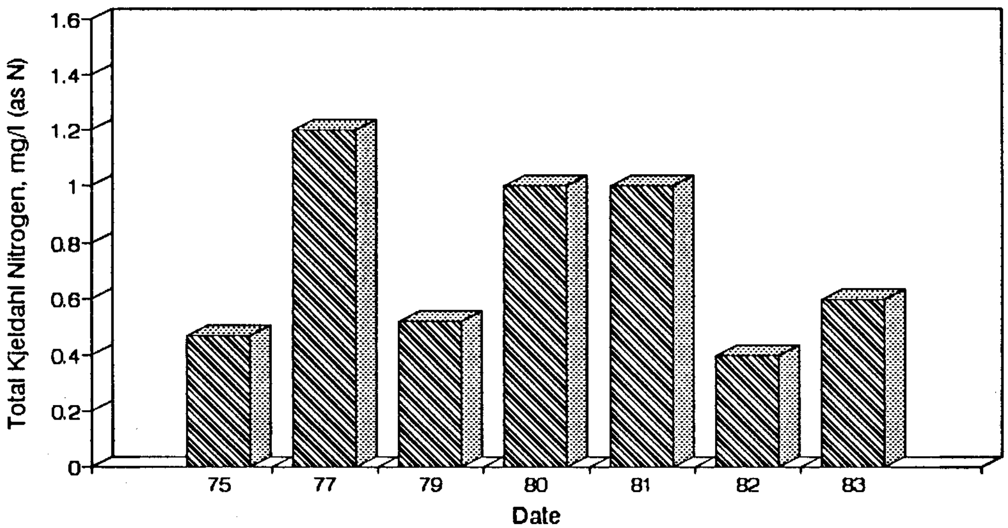

Figure A79. Graph of Total Kjeldahl Nitrogen vs. Time for the Petit Site-Aug.

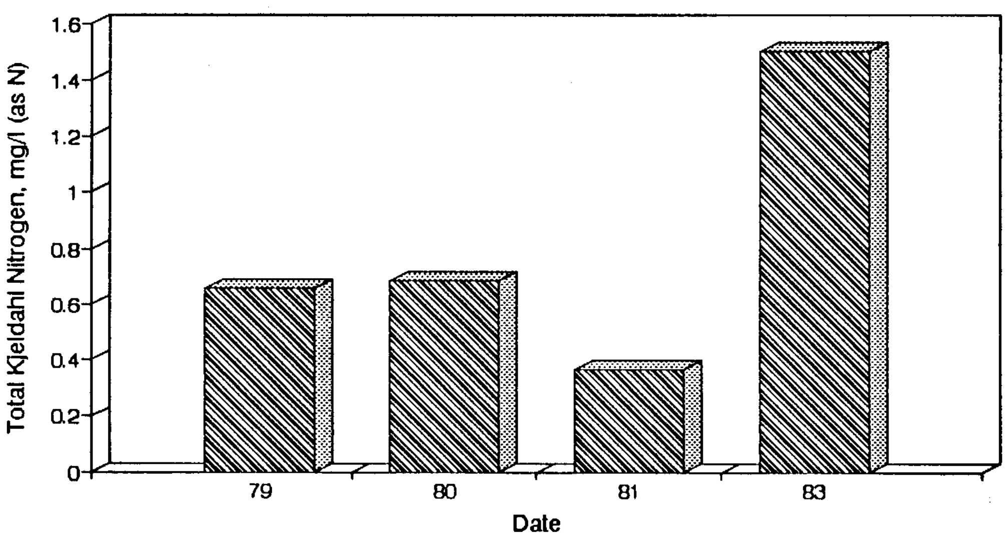

Figure A80. Graph of Total Kjeldahl Nitrogen vs. Time for the Petit Site-Dec.

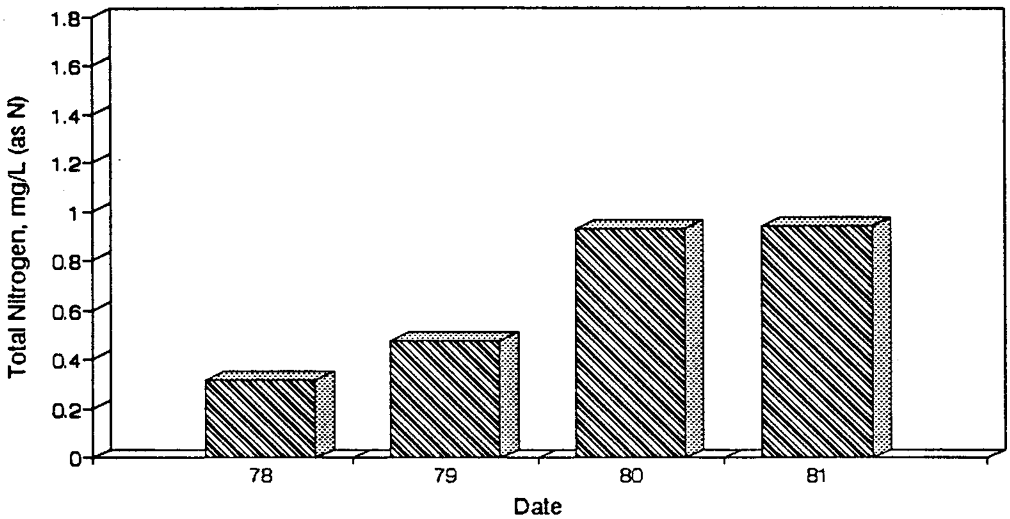

Figure A81. Graph of Total Nitrogen vs. Time for the Petit Site-May.

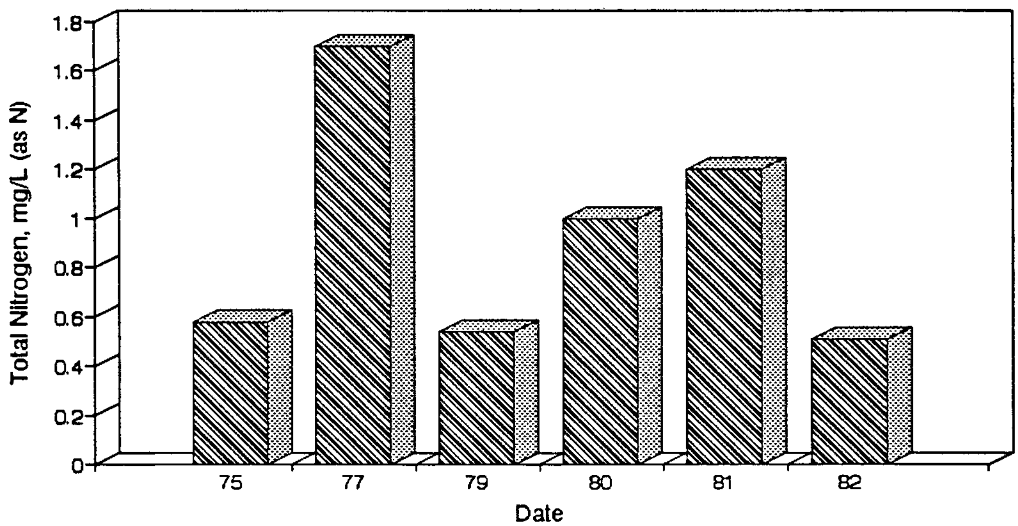

Figure A82. Graph of Total Nitrogen vs. Time for the Petit Site-Aug.

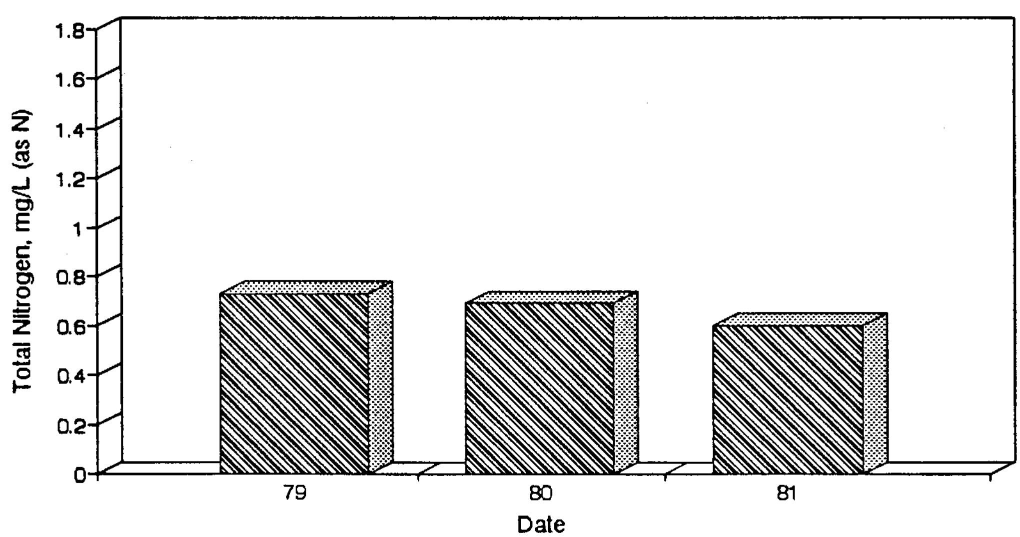

Figure A83. Graph of Total Nitrogen vs. Time for the Petit Site-Dec.

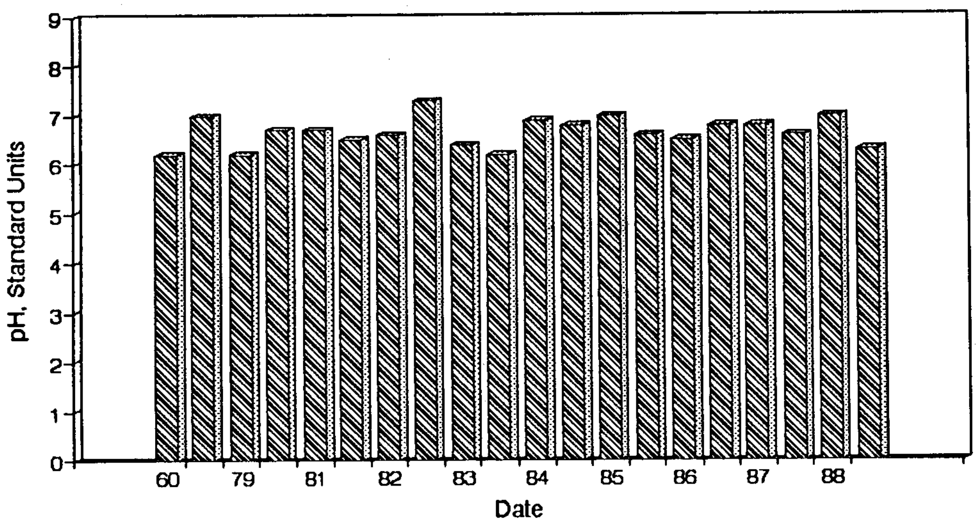

Figure A84. Graph of pH vs. Time for the Petit Site-May.

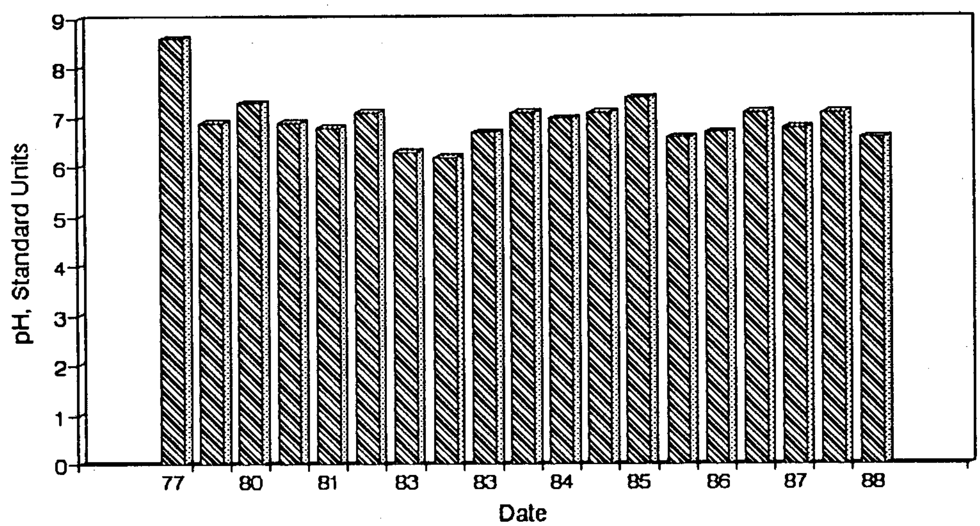

Figure A85. Graph of pH vs. Time for the Petit Site-Aug.

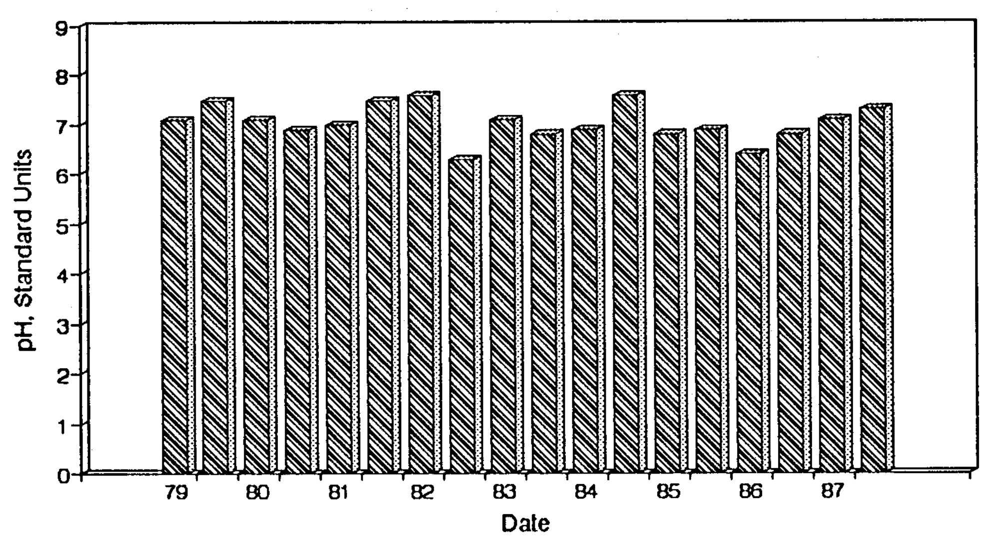

Figure A86. Graph of pH vs. Time for the Petit Site-Dec.

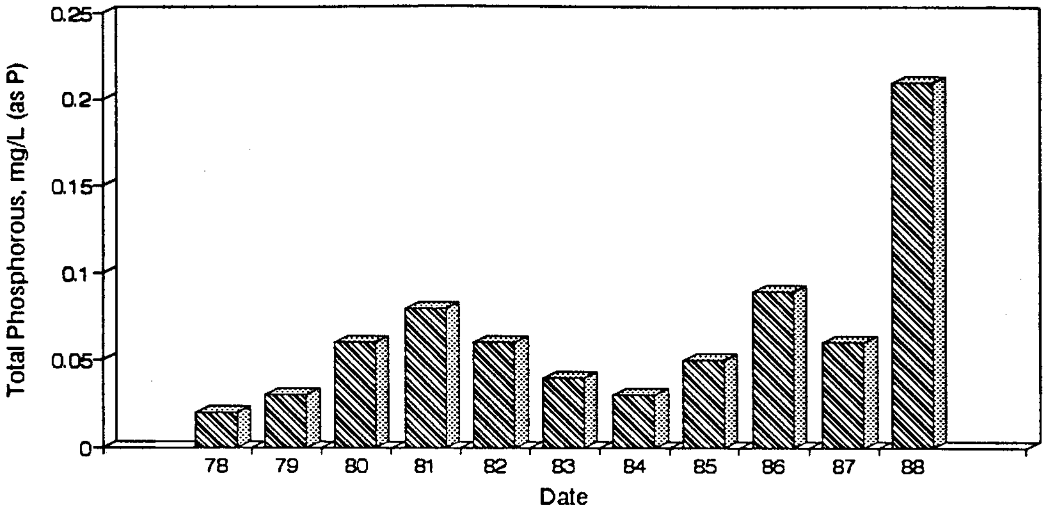

Figure A87. Graph of Total Phosphorous vs. Time for the Petit Site-May.

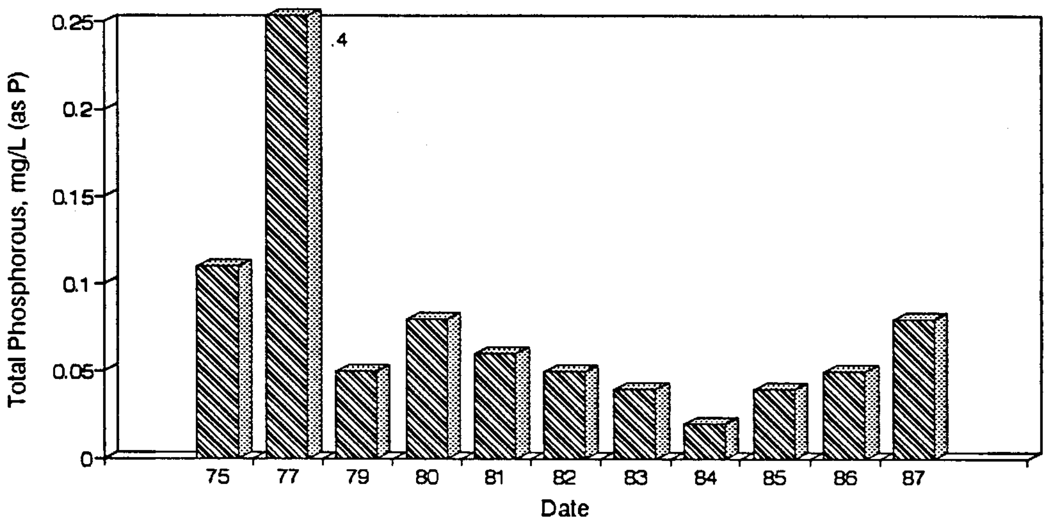

Figure A88. Graph of Total Phosphorous vs. Time for the Petit Site-Aug.

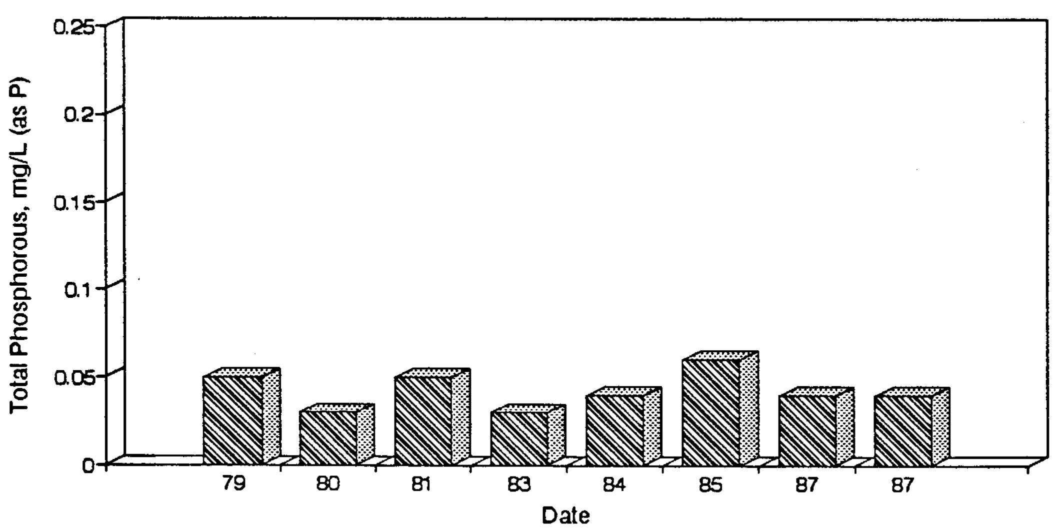

Figure A89. Graph of Total Phosphorous vs. Time for the Petit Site-Dec.

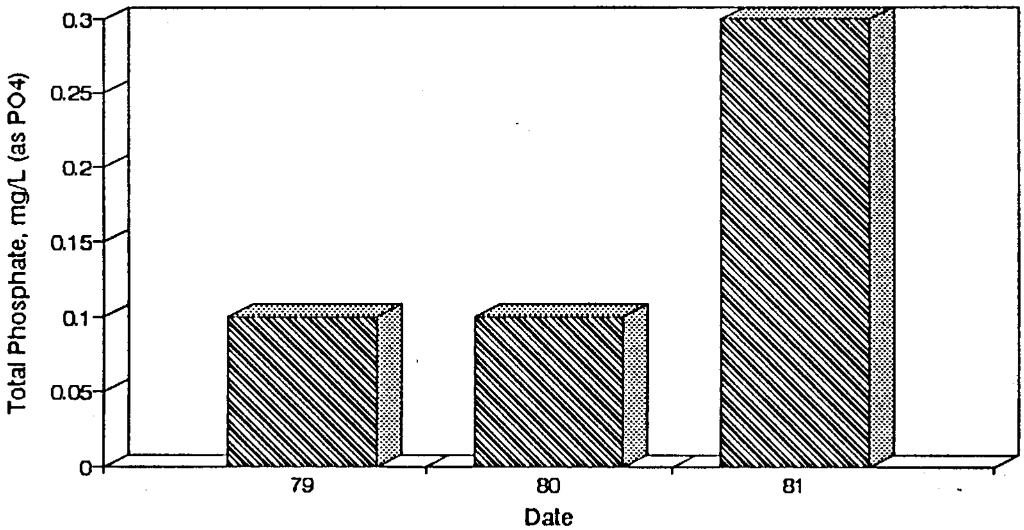

Figure A90. Graph of Total Phosphate vs. Time for the Petit Site-May.

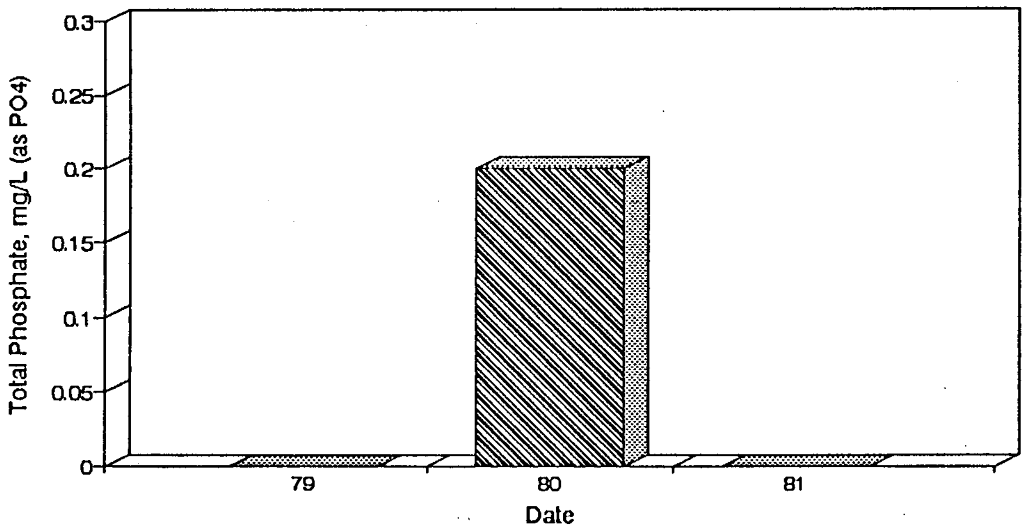

Figure A91. Graph of Total Phosphate vs. Time for the Petit Site-Aug.

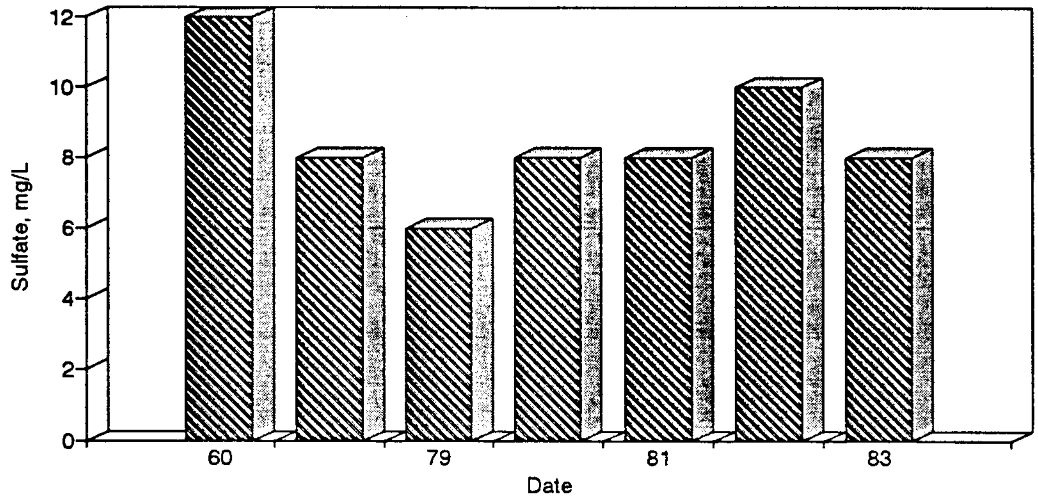

Figure A92. Graph of Sulfate vs. Time for the Petit Site-May.

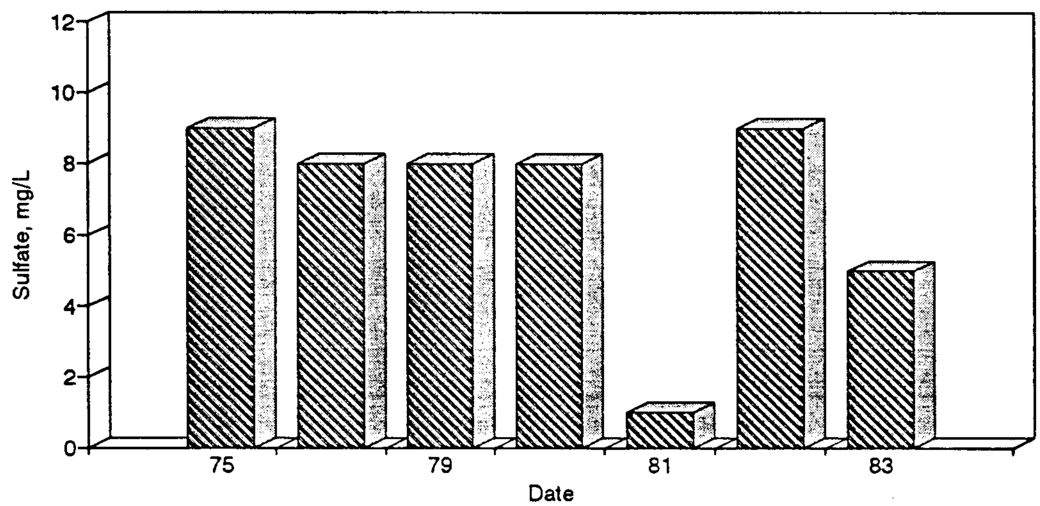

Figure A93. Graph of Sulfate vs. Time for the Petit Site-Aug.

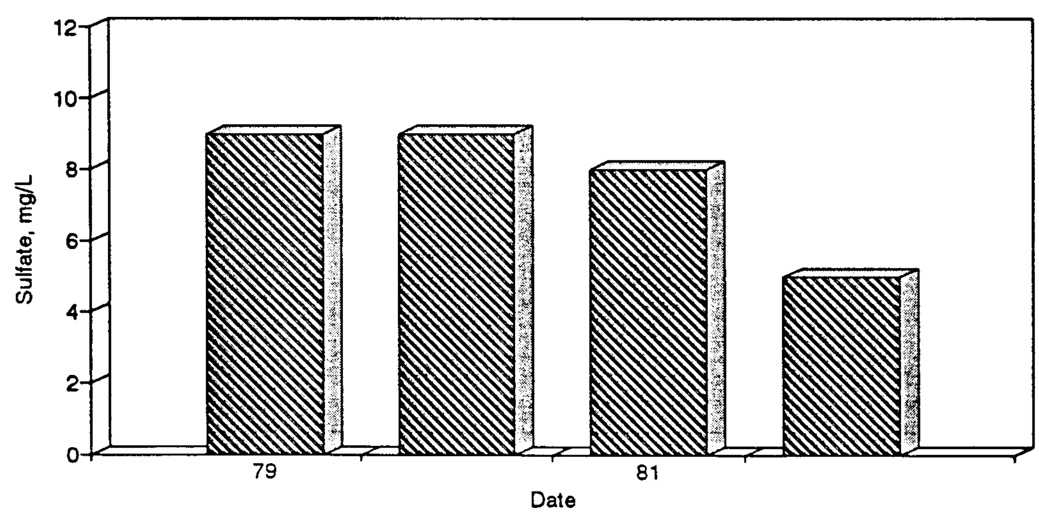

Figure A94. Graph of Sulfate vs. Time for the Petit Site-Dec.

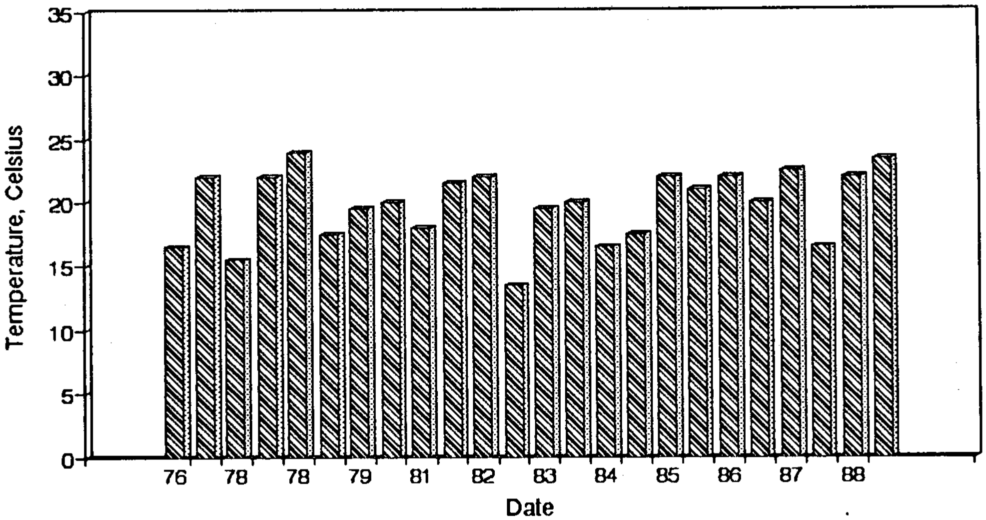

Figure A95. Graph of Temperature vs. Time for the Petit Site-May.

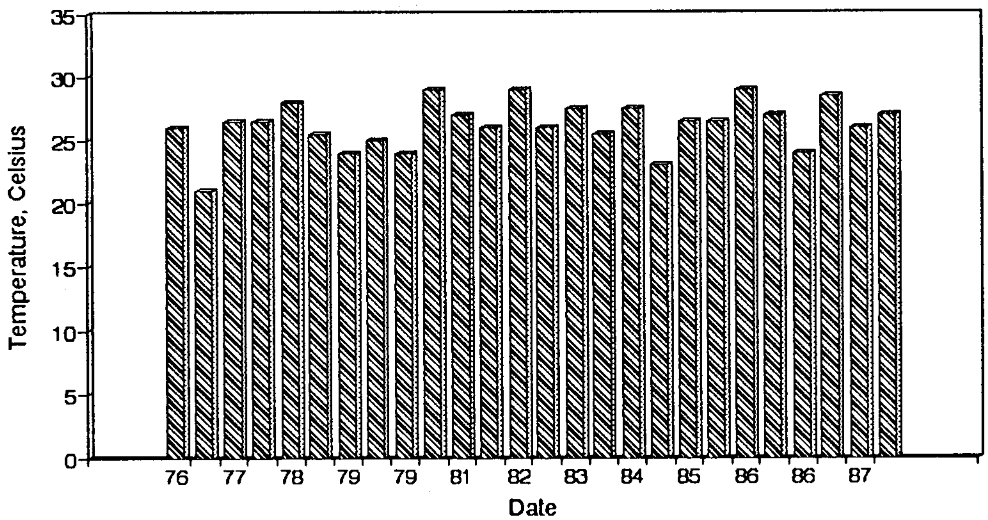

Figure A96. Graph of Temperature vs. Time for the Petit Site-Aug.

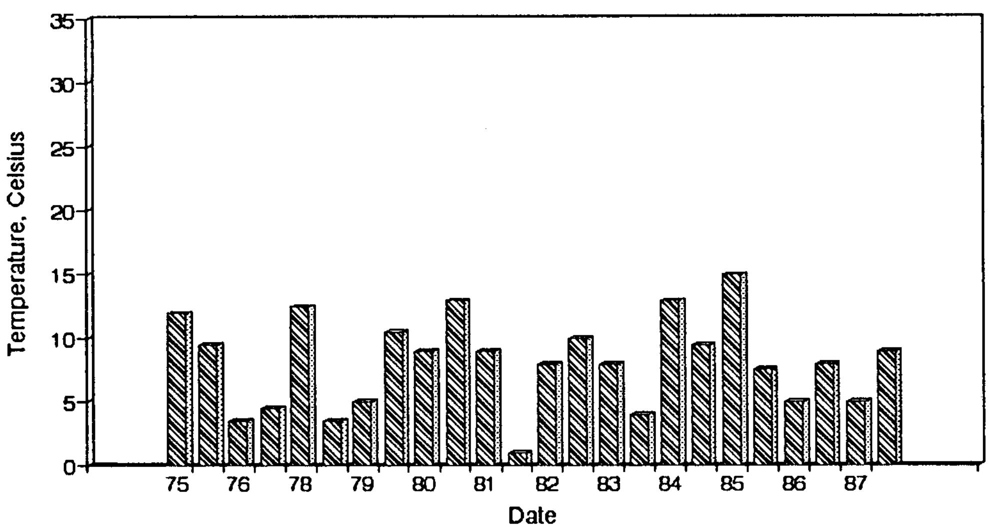

Figure A97. Graph of Temperature vs. Time for the Petit Site-Dec.

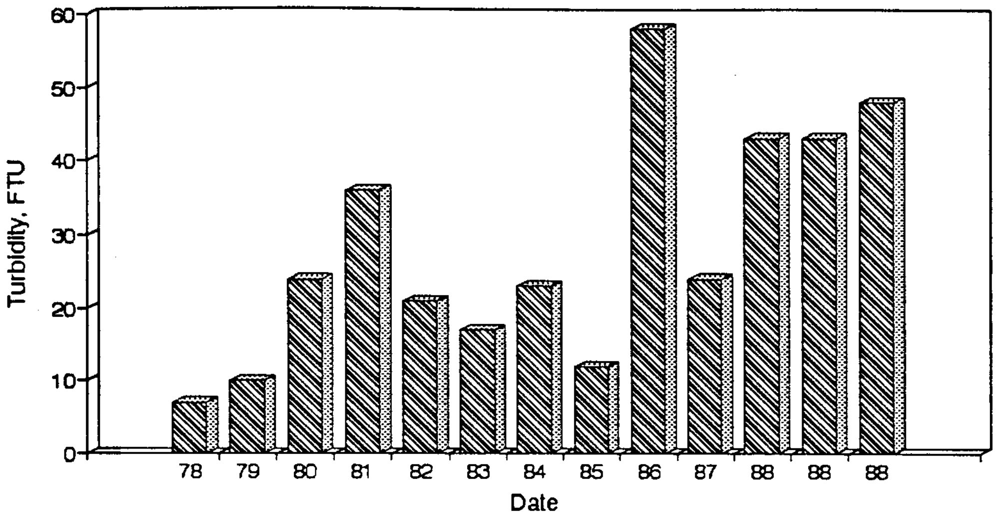

Figure A98. Graph of Turbidity vs. Time for the Petit Site-May.

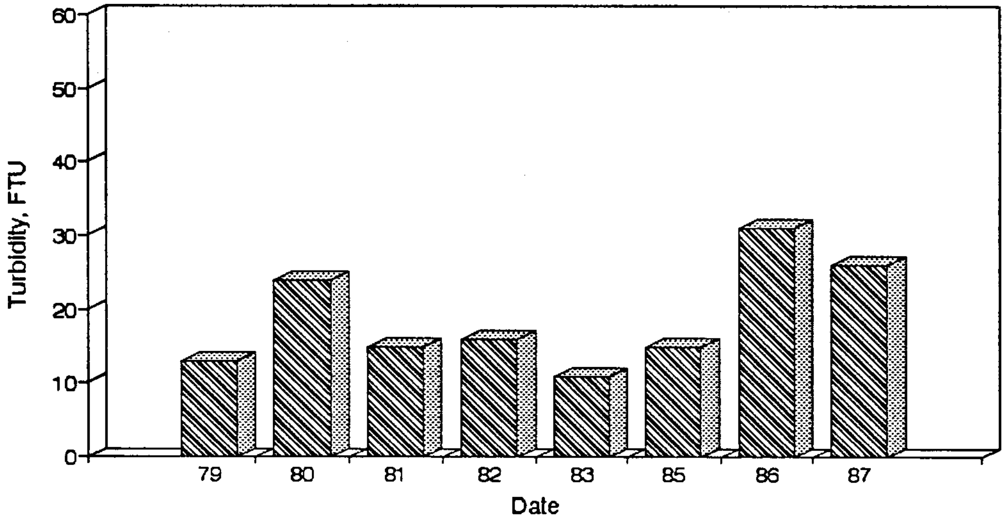

Figure A99. Graph of Turbidity vs. Time for the Petit Site-Aug.

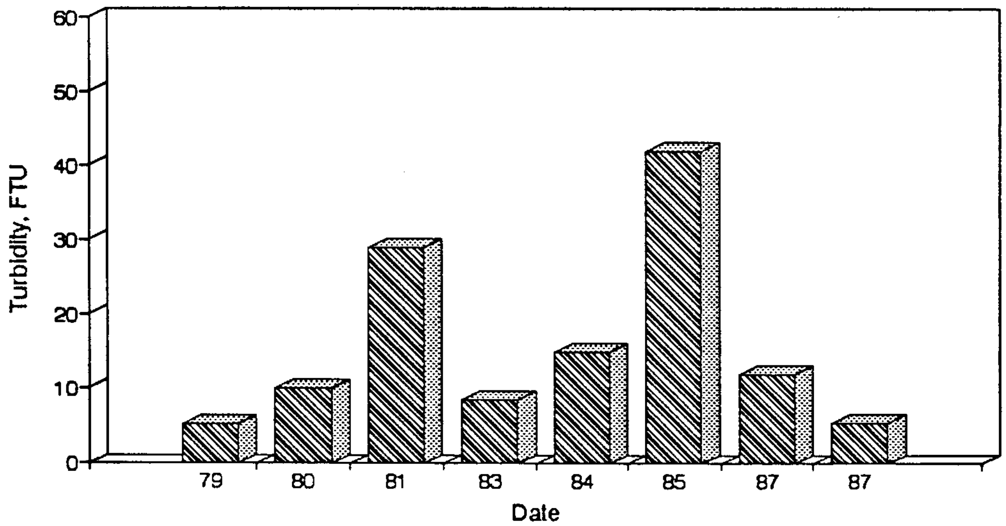

Figure A100. Graph of Turbidity vs. Time for the Petit Site-Dec.

APPENDIX BD

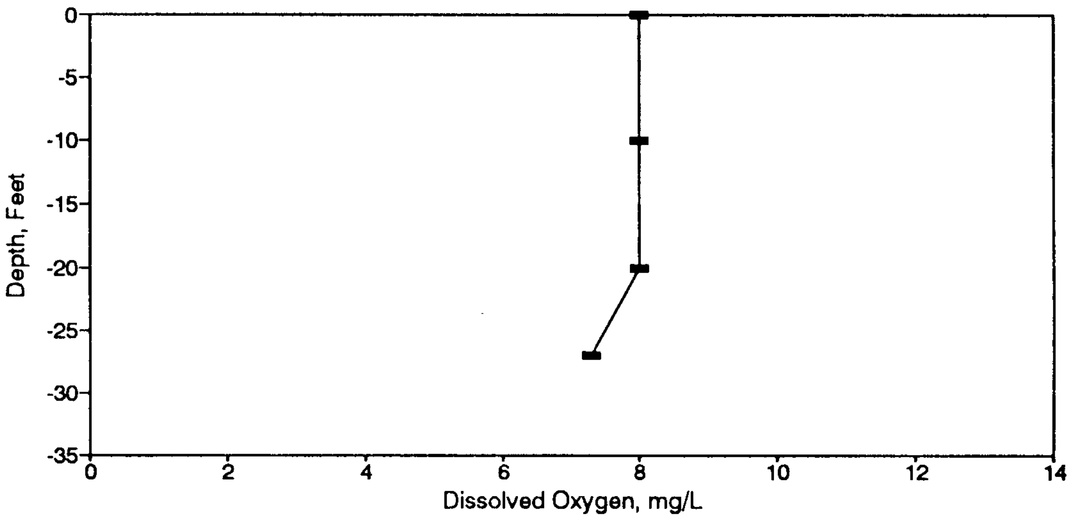

Figure BD1. Dissolved Oxygen Profile for the Waveland Site-October 15, 1980.

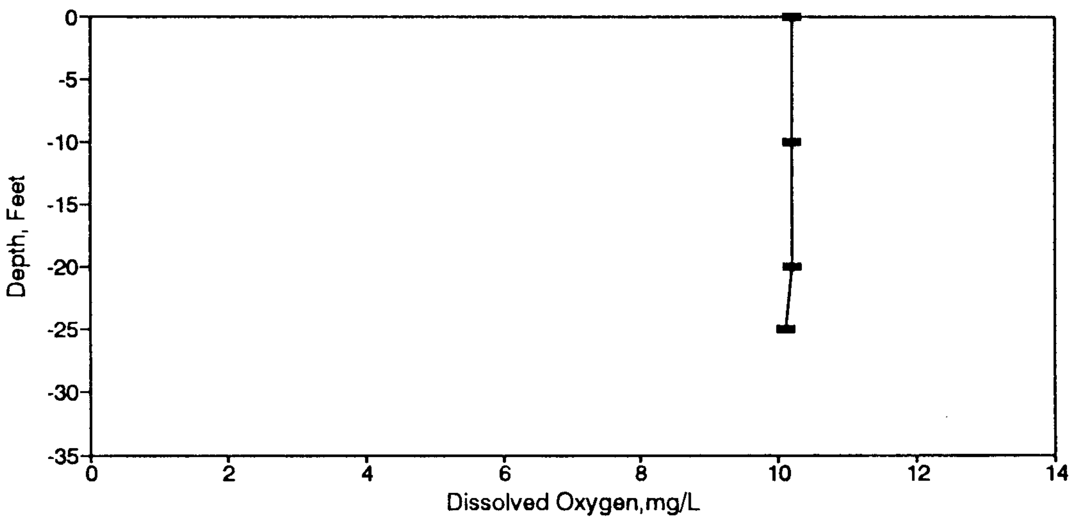

Figure BD2. Dissolved Oxygen Profile for the Waveland Site-November 18, 1980

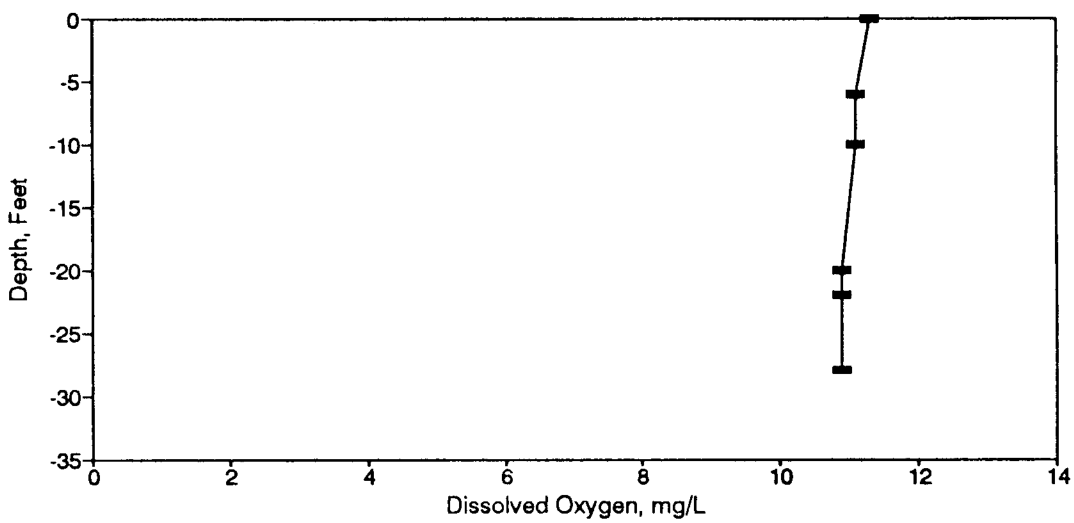

Figure BD3. Dissolved Oxygen Profile for the Waveland Site-December 9, 1980.

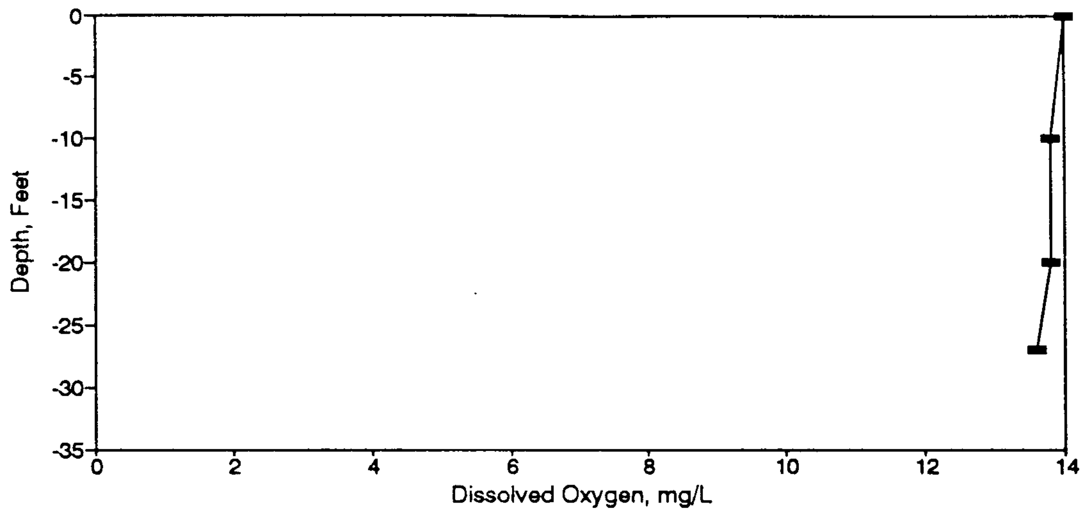

Figure BD4. Dissolved Oxygen Profile for the Waveland Site-February 2, 1981.

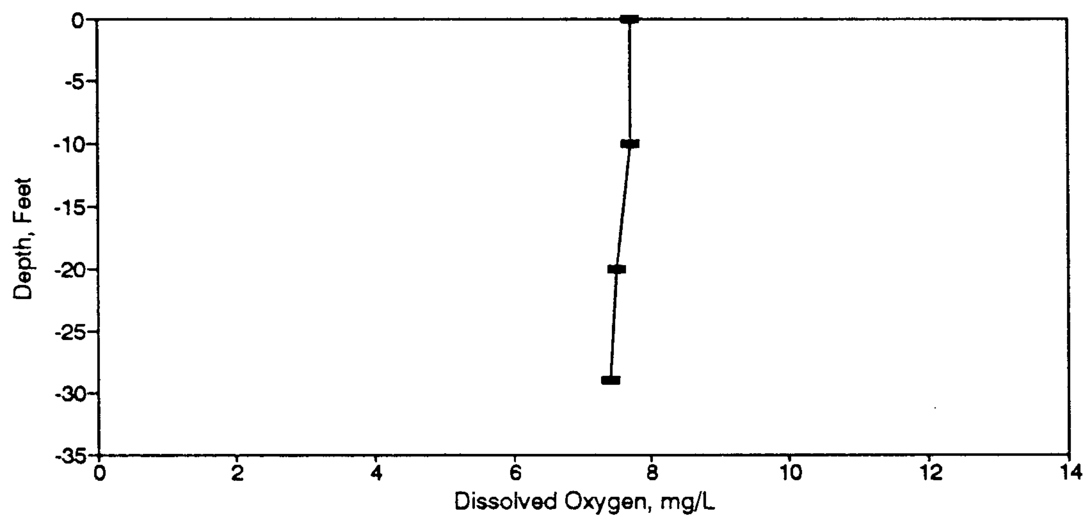

Figure BD5. Dissolved Oxygen Profile for the Waveland Site-March 3, 1981.

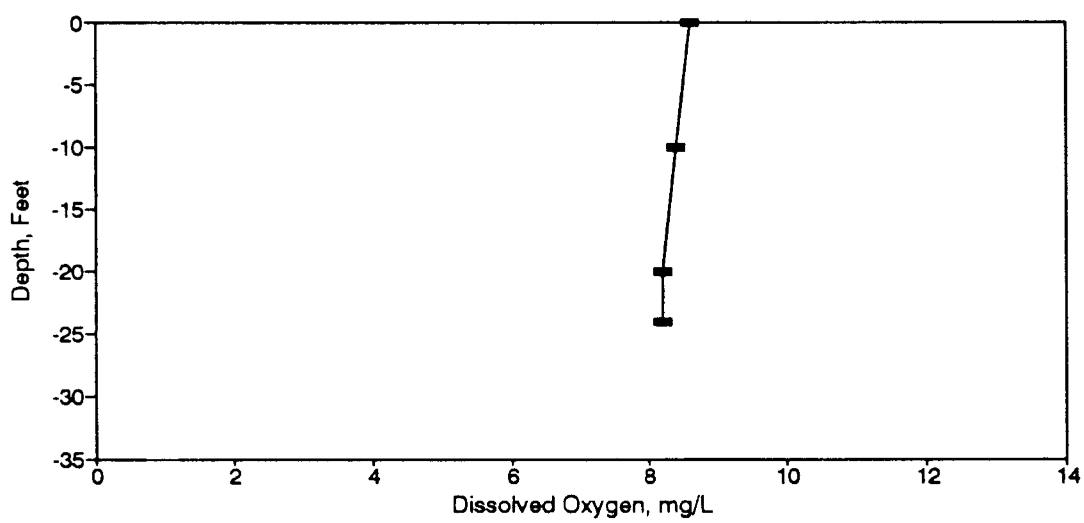

Figure BD6. Dissolved Oxygen Profile for the Waveland Site-April 7, 1981.

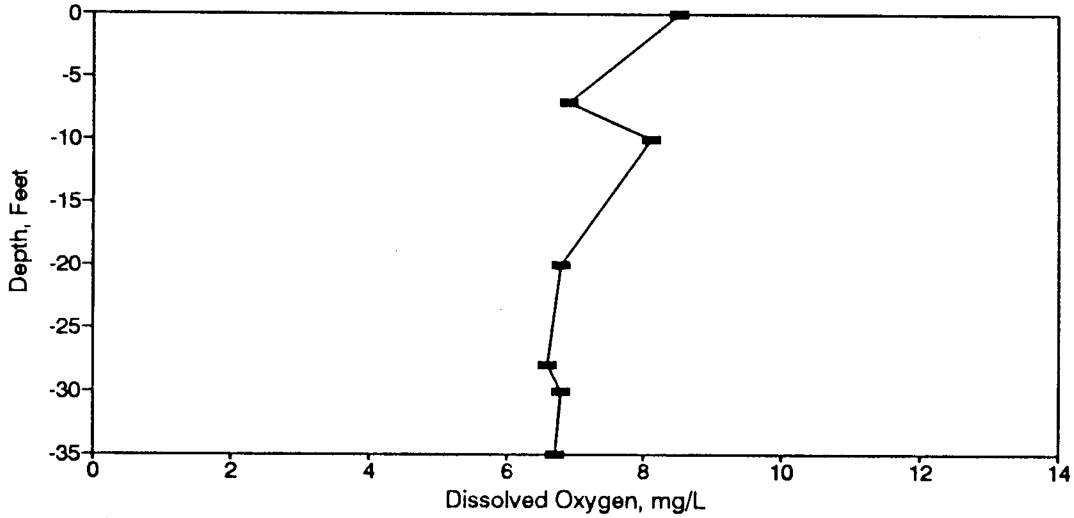

Figure BD7. Dissolved Oxygen Profile for the Waveland Site-May 12, 1981.

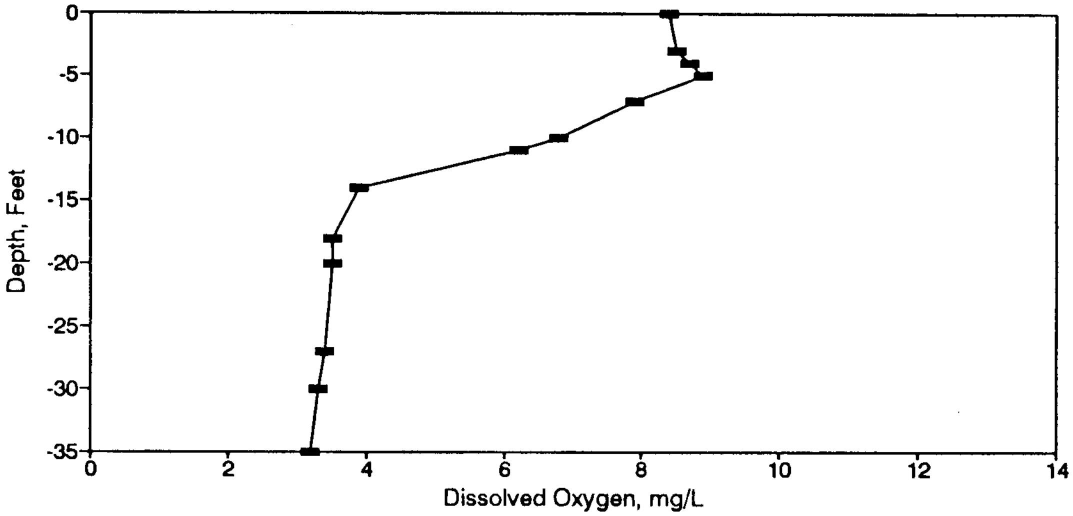

Figure BD8. Dissolved Oxygen Profile for the Waveland Site-June 9, 1981.

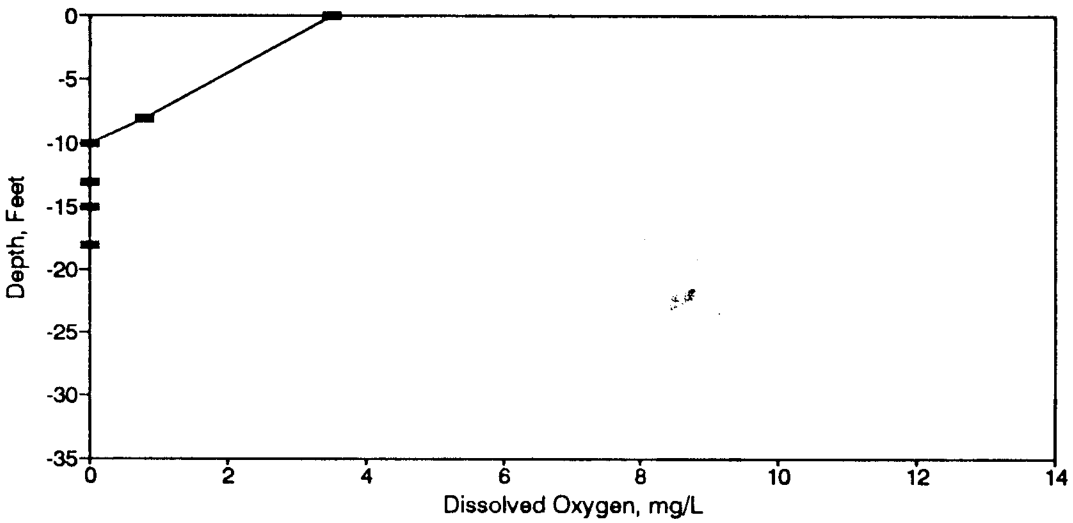

Figure BD9. Dissolved Oxygen Profile for the Waveland Site-July 7, 1981.

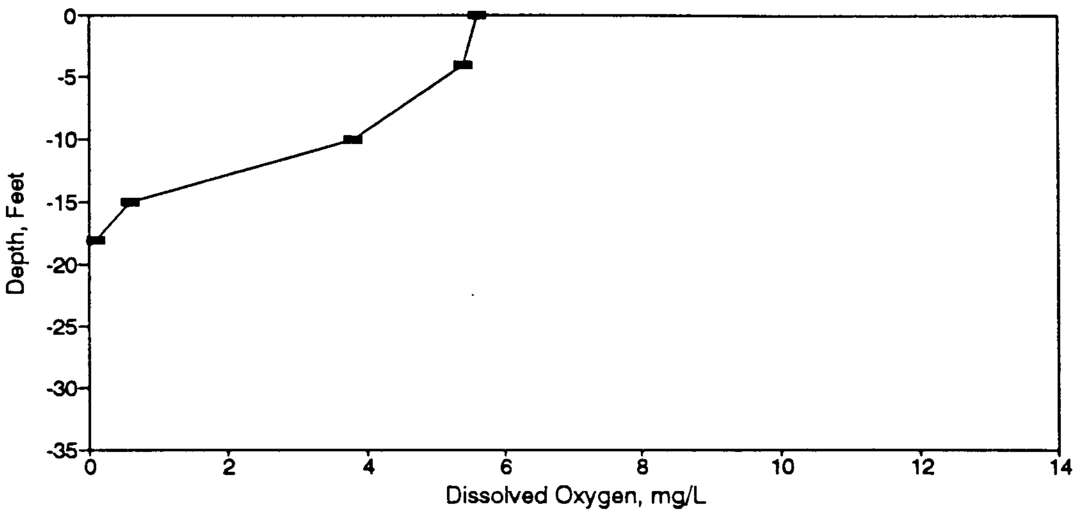

Figure BD10. Dissolved Oxygen Profile for the Waveland Site-August 11, 1981.

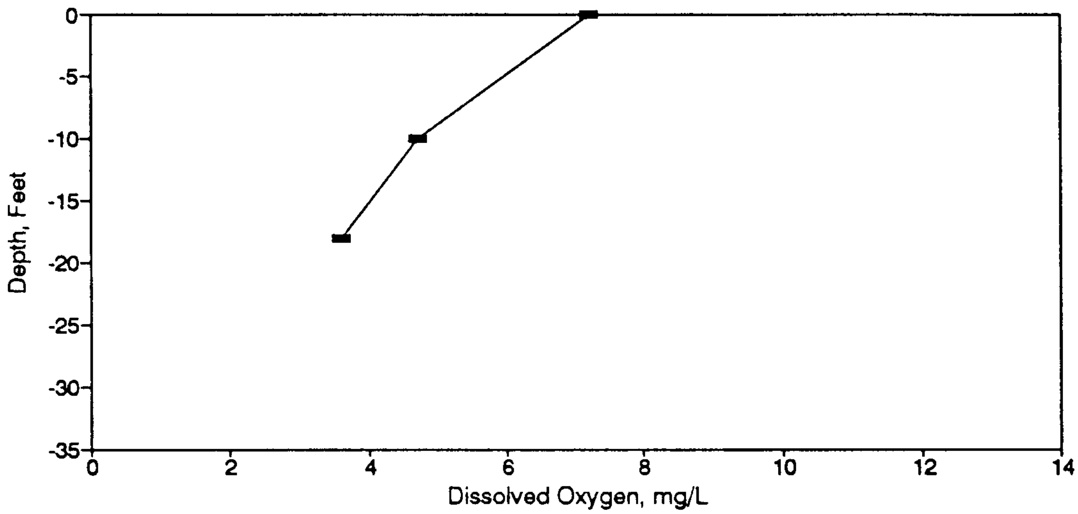

Figure BD11. Dissolved Oxygen Profile for the Waveland Site-September 9, 1981.

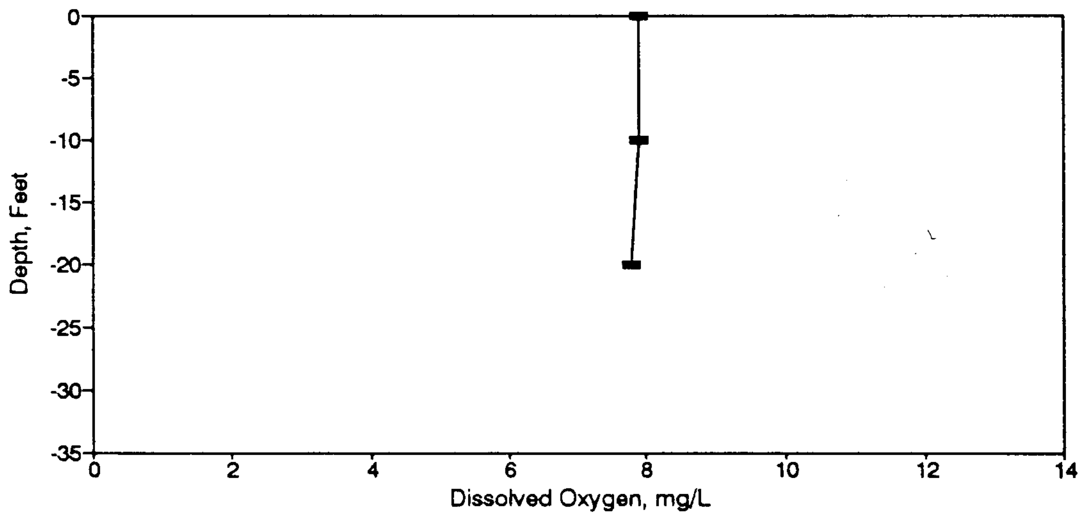

Figure BD12. Dissolved Oxygen Profile for the Waveland Site-October 13, 1981.

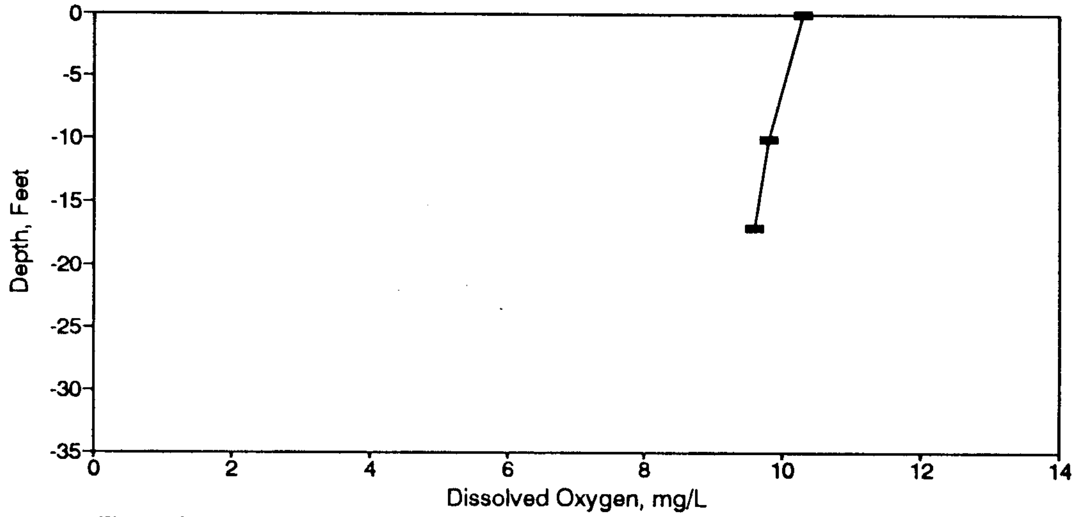

Figure BD13. Dissolved Oxygen Profile for the Waveland Site-November 19,1981.

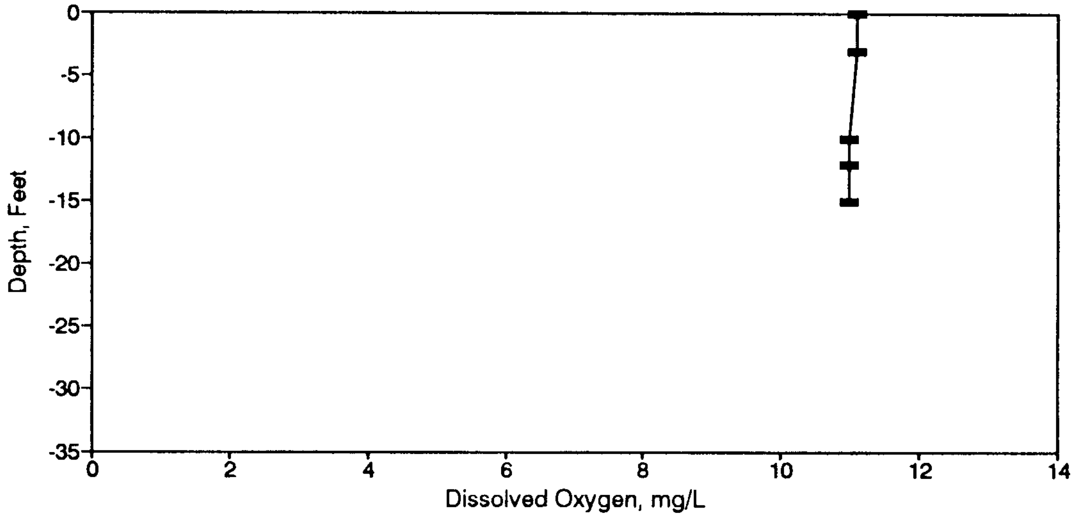

Figure BD14. Dissolved Oxygen Profile for the Waveland Site-December 8, 1981.

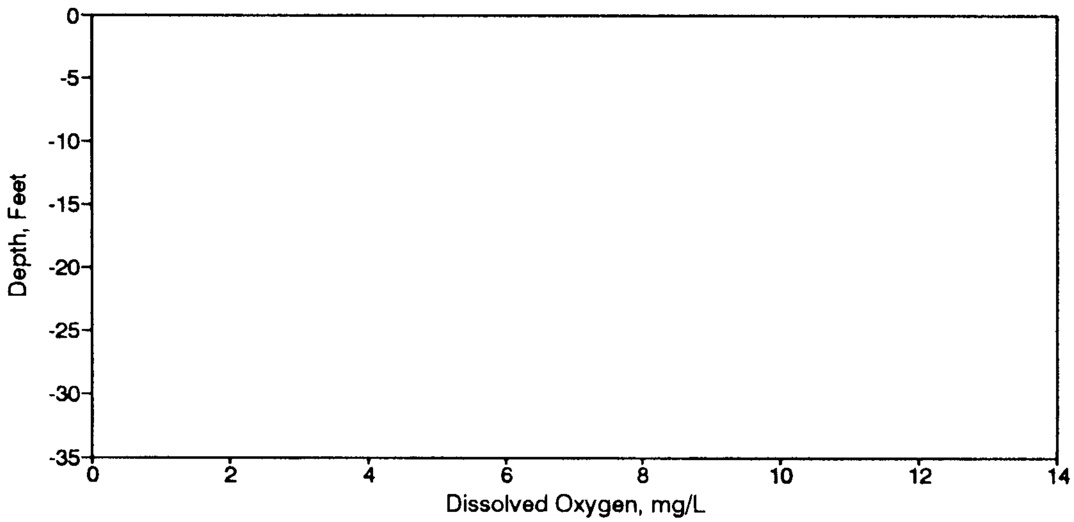

Figure BD15. Dissolved Oxygen Profile for the Waveland Site-January 15, 1982.

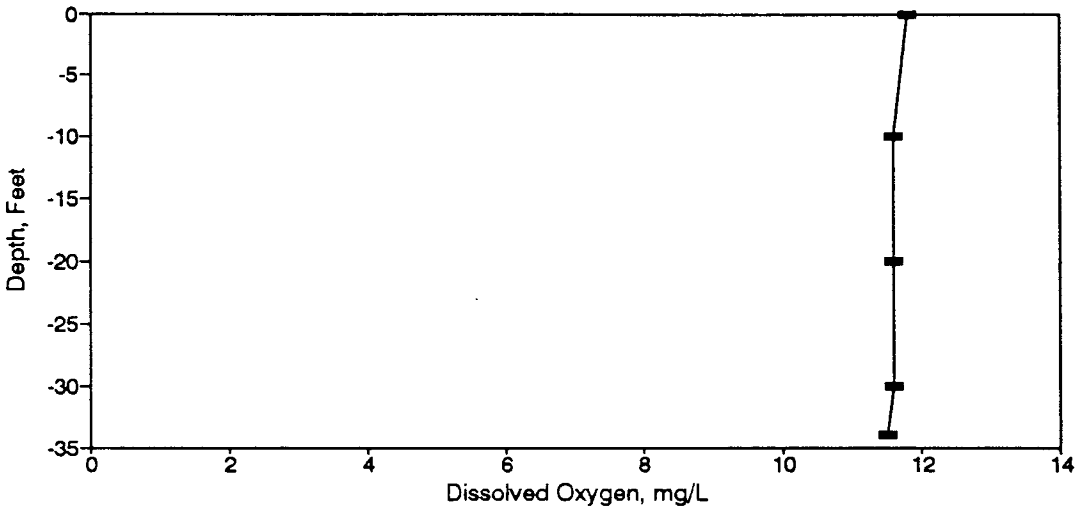

Figure BD16. Dissolved Oxygen Profile for the Waveland Site-February 12, 1982.

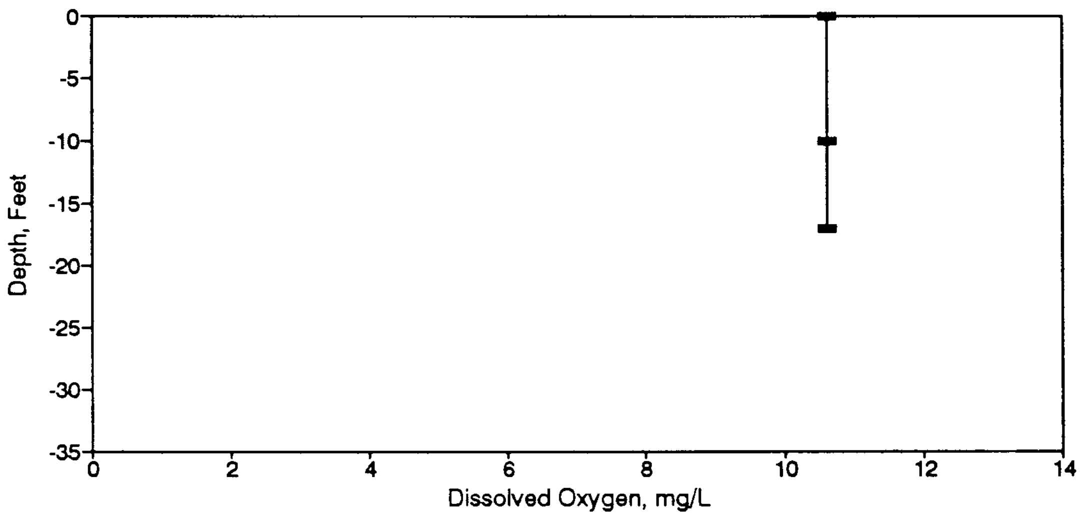

Figure BD17. Dissolved Oxygen Profile for the Waveland Site-March 15, 1982.

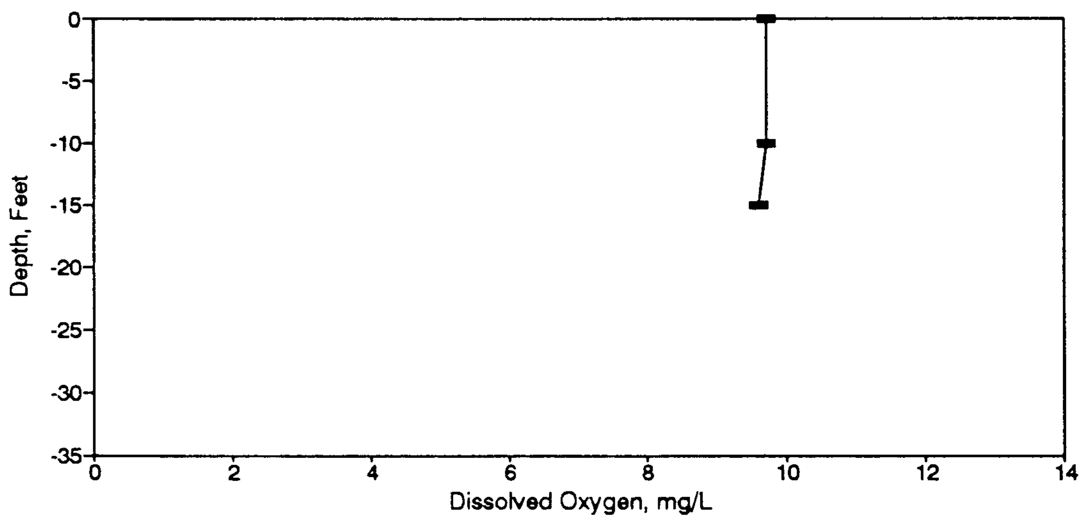

Figure BD18. Dissolved Oxygen Profile for the Waveland Site-April 2, 1982.

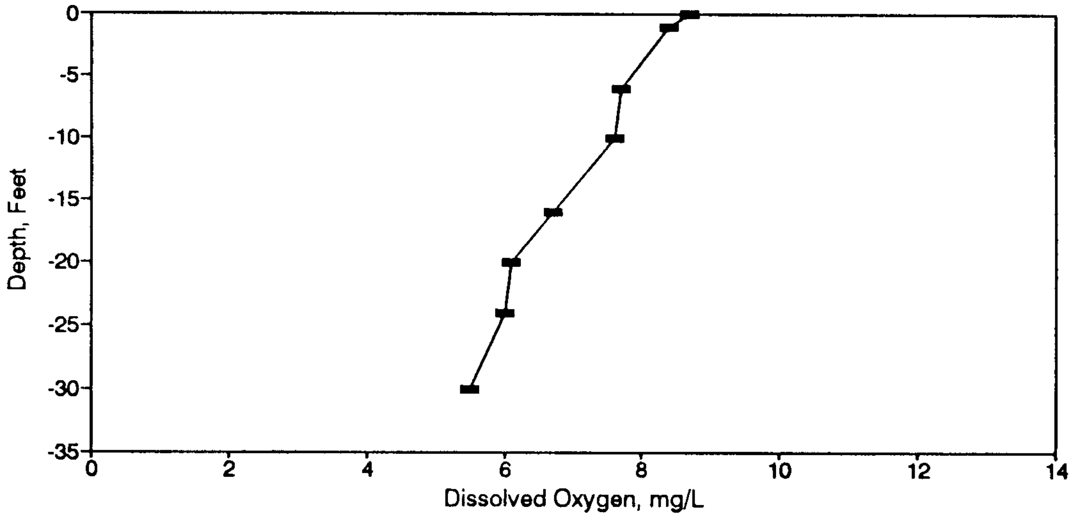

Figure BD19. Dissolved Oxygen Profile for the Waveland Site-May 17, 1982.

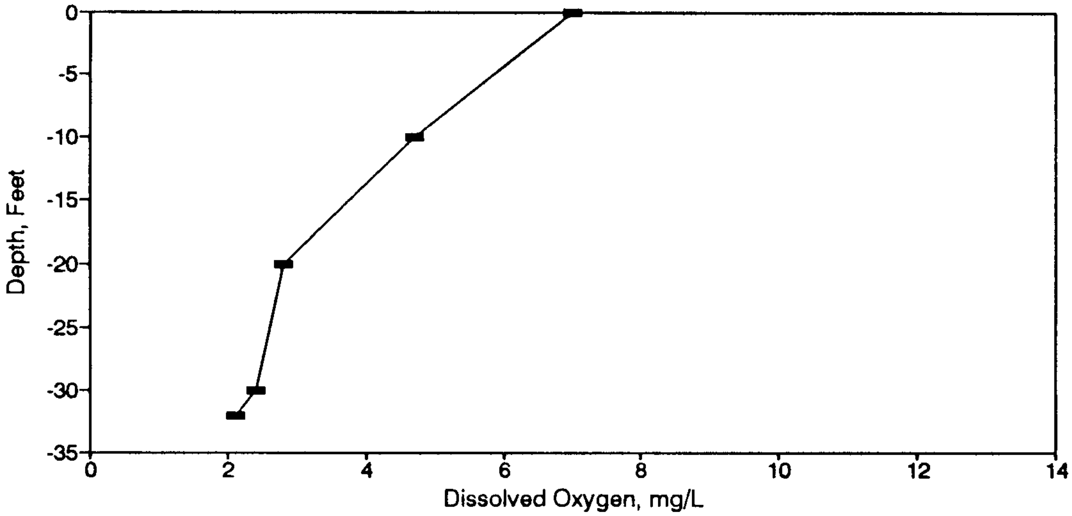

Figure BD20. Dissolved Oxygen Profile for the Waveland Site-June 18, 1982.

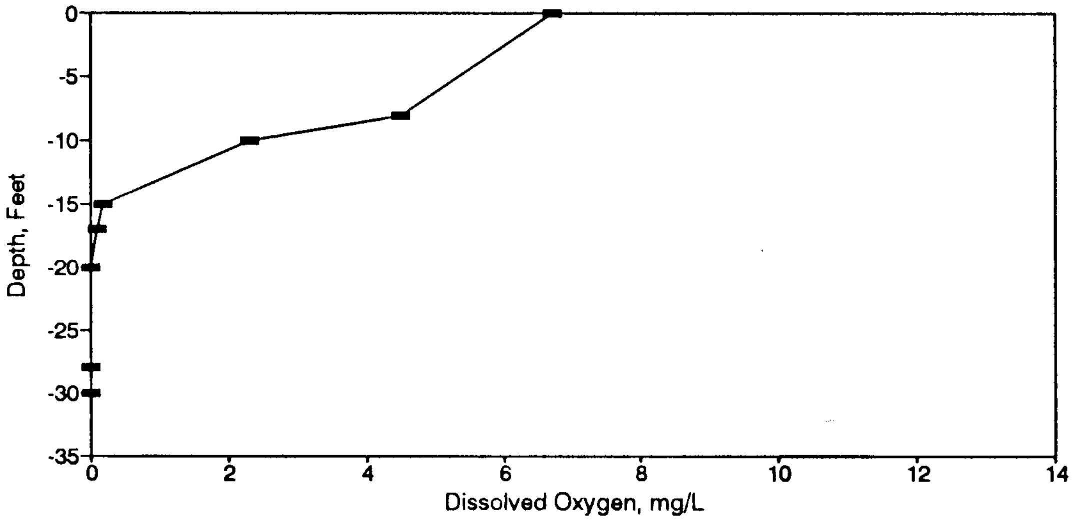

Figure BD21. Dissolved Oxygen Profile for the Waveland Site-July 12, 1982.

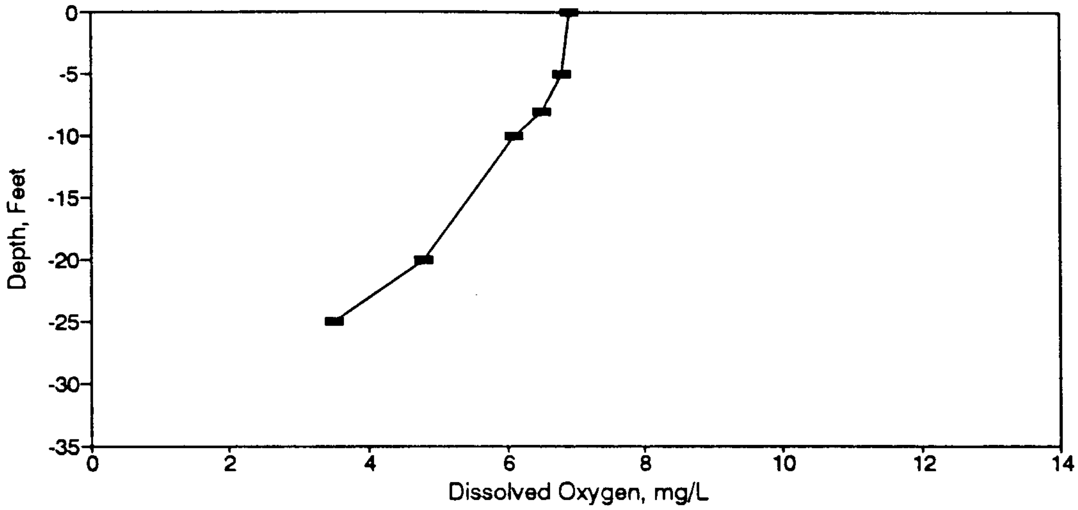

Figure BD22. Dissolved Oxygen Profile for the Waveland Site-August 16, 1982.

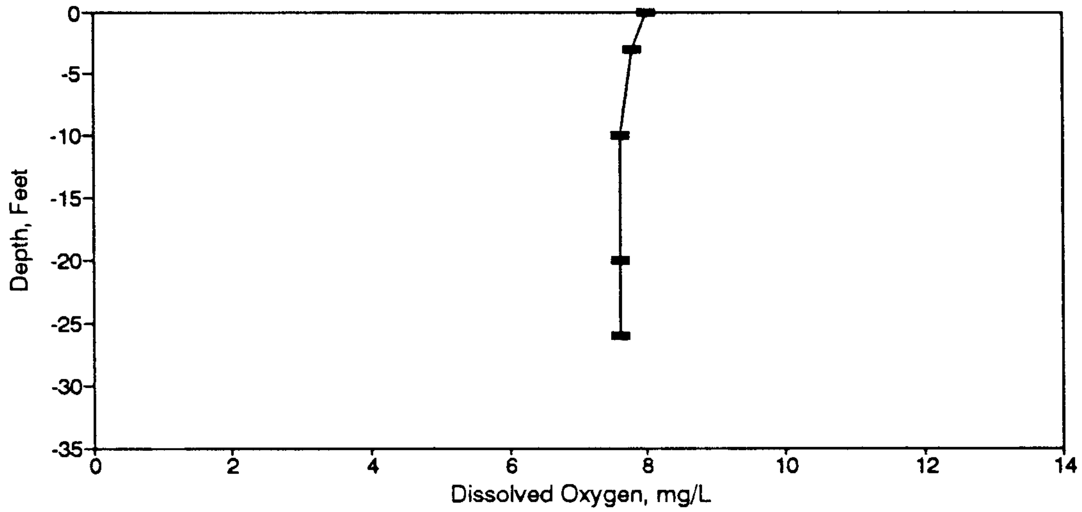

Figure BD23. Dissolved Oxygen Profile for the Waveland Site-September 29, 1982.

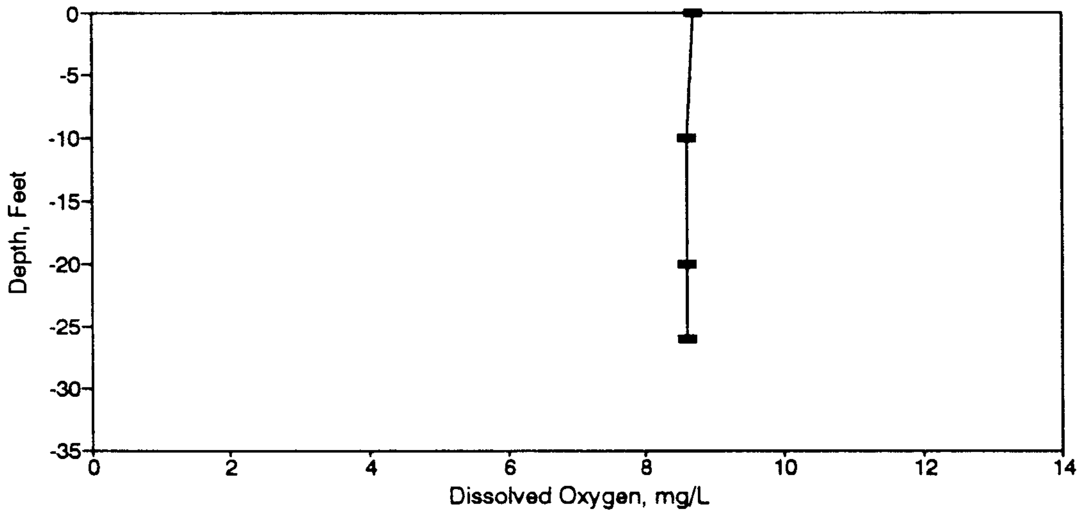

Figure BD24. Dissolved Oxygen Profile for the Waveland Site-October 15, 1982.

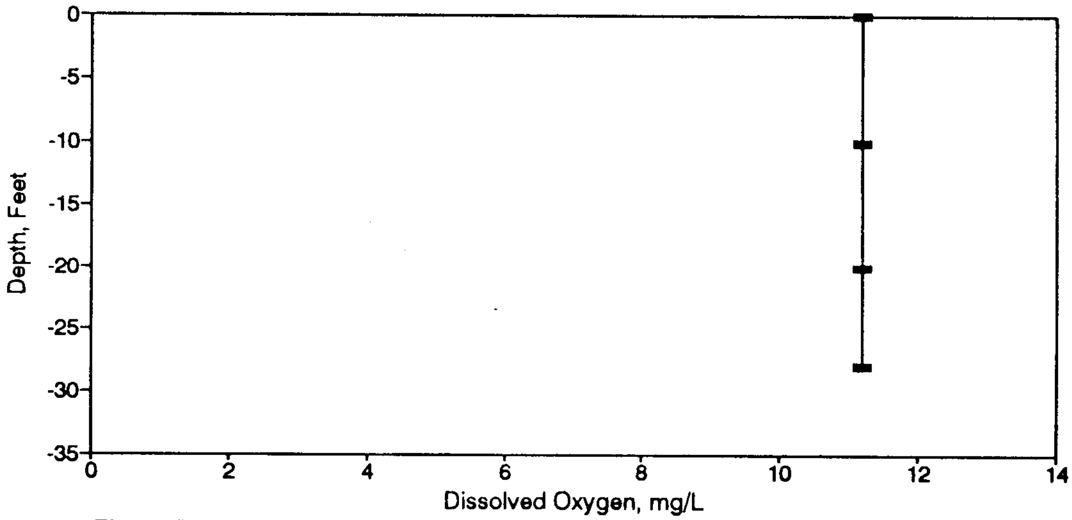

Figure BD25. Dissolved Oxygen Profile for the Waveland Site-November 16, 1982.

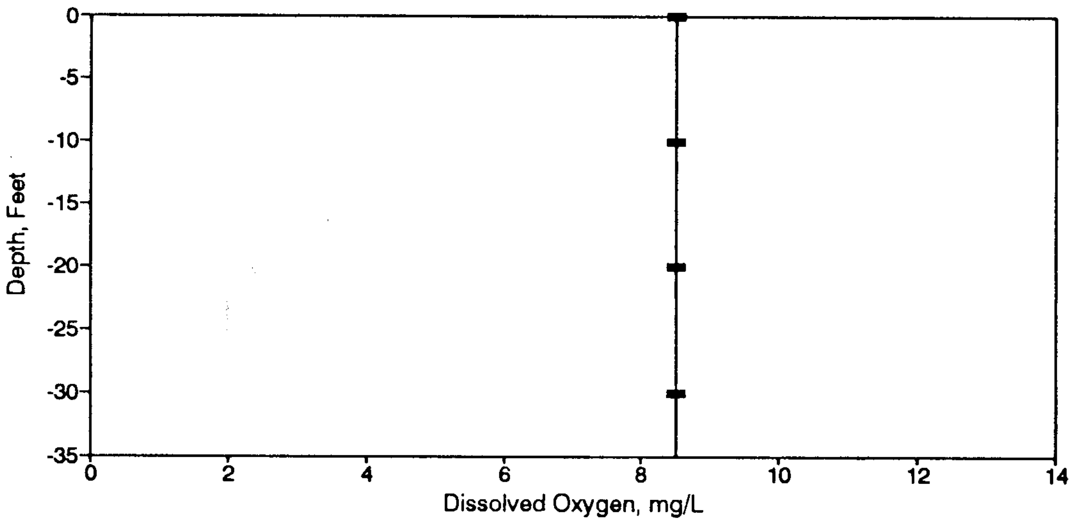

Figure BD26. Dissolved Oxygen Profile for the Waveland Site-December 20, 1982.

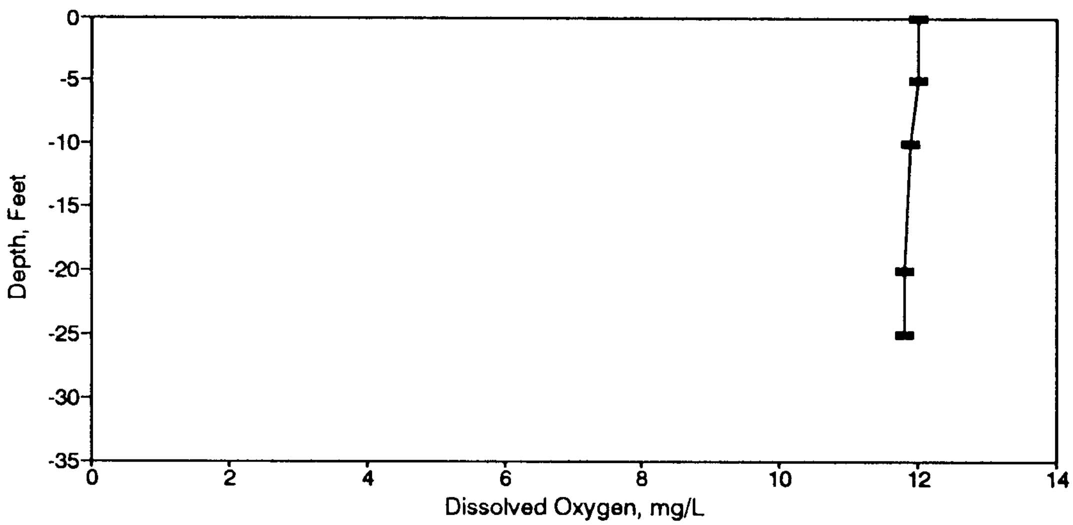

Figure BD27. Dissolved Oxygen Profile for the Waveland Site-January 26, 1983.

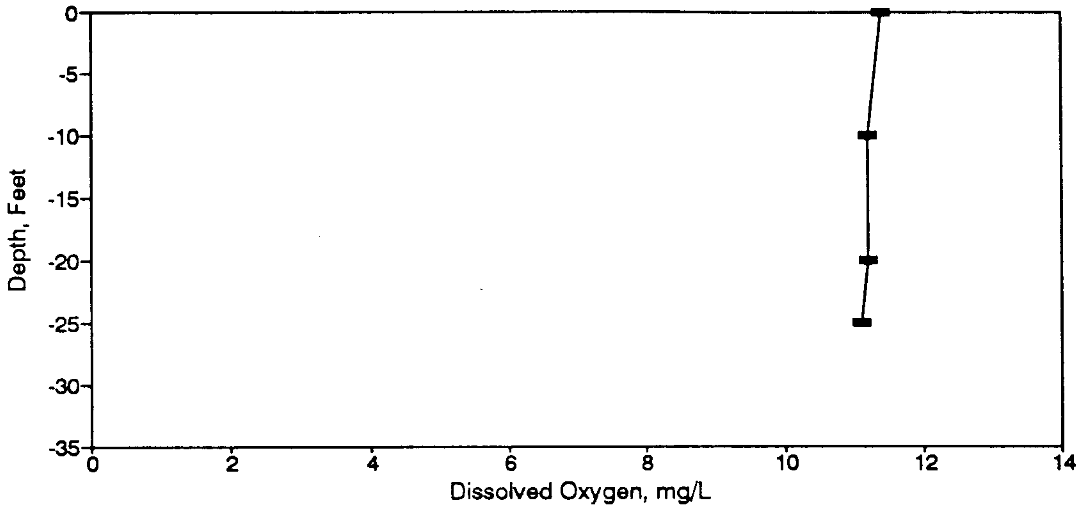

Figure BD28. Dissolved Oxygen Profile for the Waveland Site-February 18, 1983.

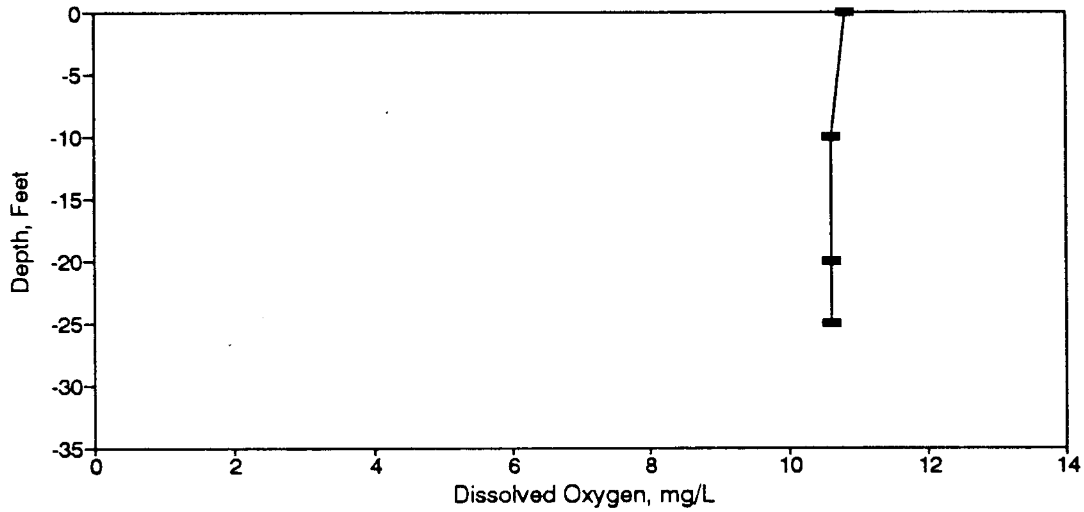

Figure BD29. Dissolved Oxygen Profile for the Waveland Site-March 25, 1983.

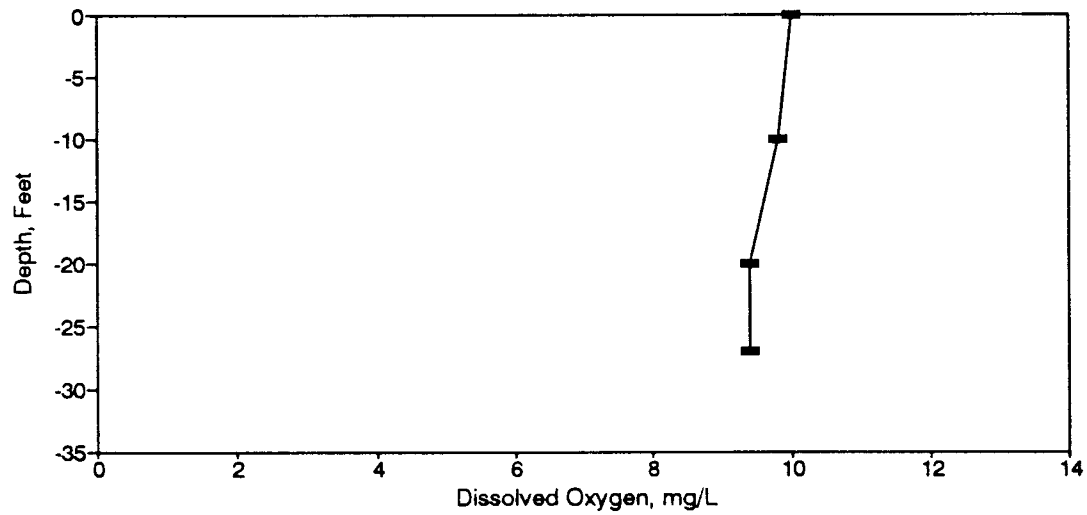

Figure BD30. Dissolved Oxygen Profile for the Waveland Site-April 18, 1983.

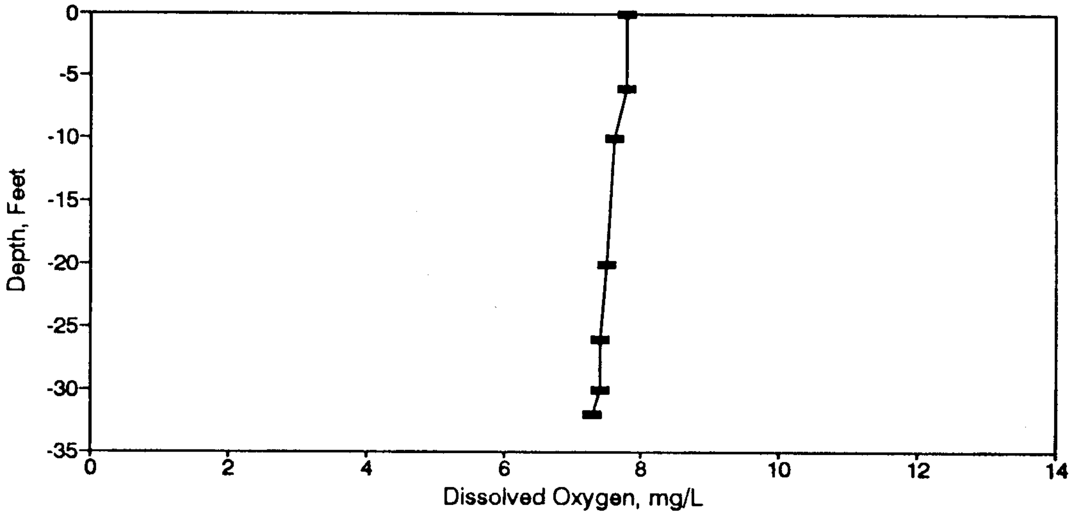

Figure BD31. Dissolved Oxygen Profile for the Waveland Site-May 16, 1983.

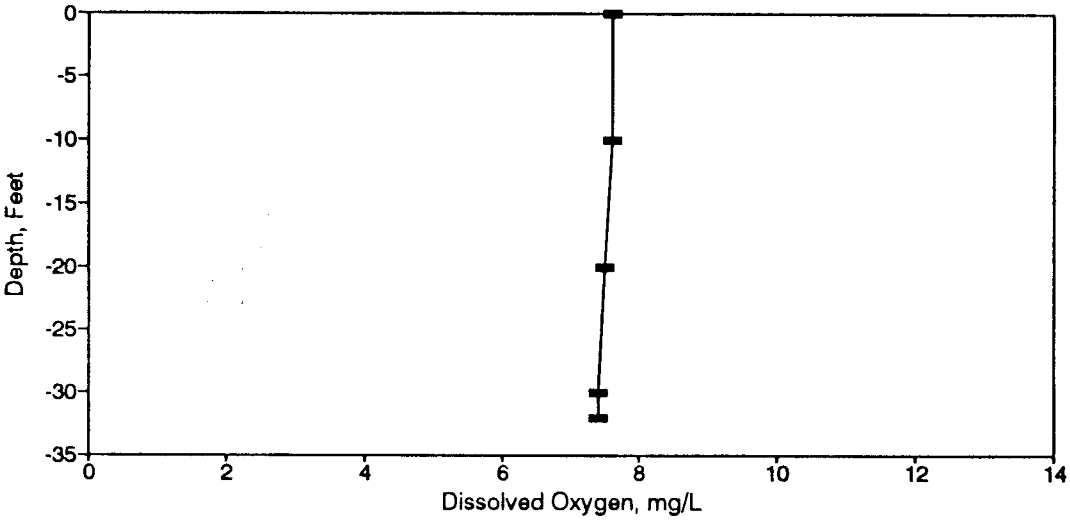

Figure BD32. Dissolved Oxygen Profile for the Waveland Site-June 9, 1983.

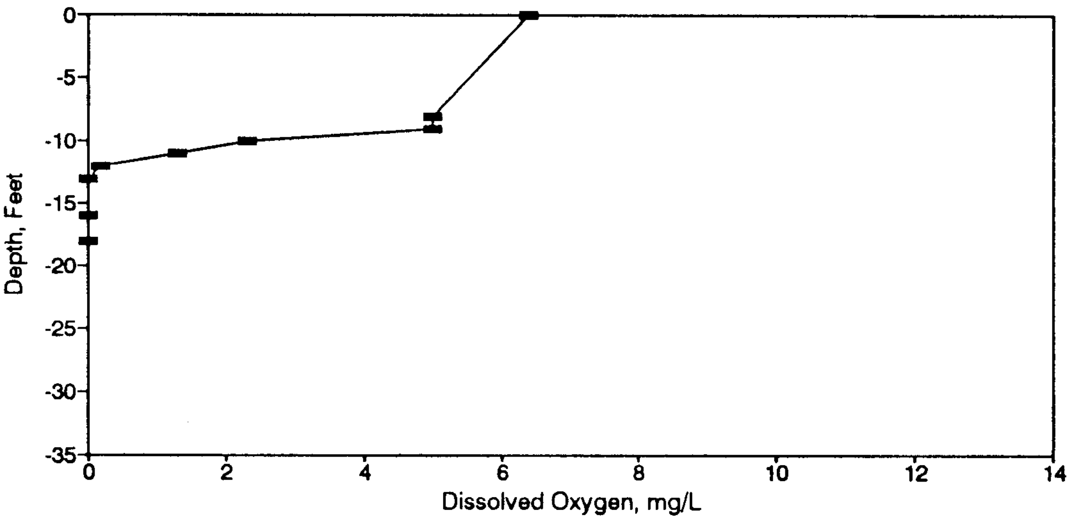

Figure BD33. Dissolved Oxygen Profile for the Waveland Site-July 22, 1983.

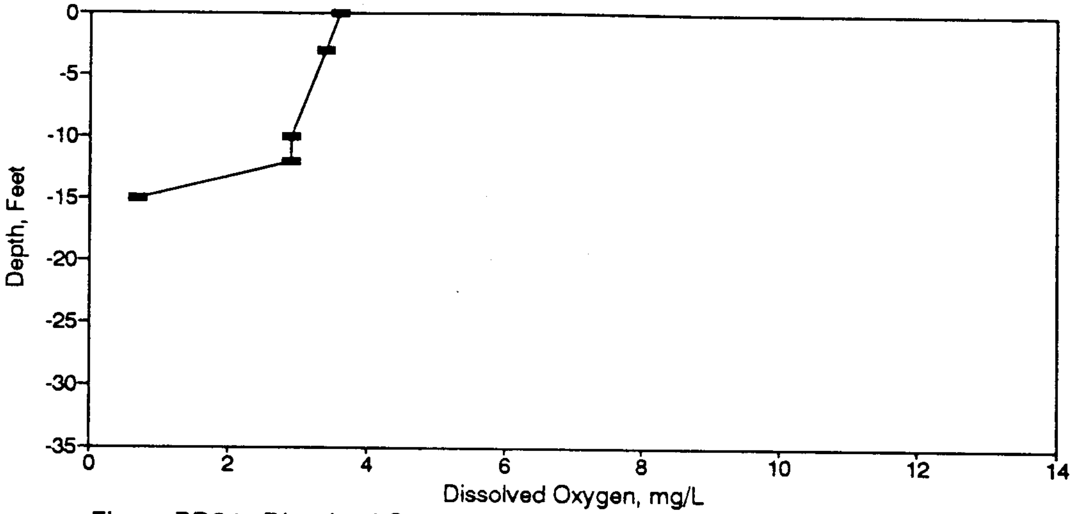

Figure BD34. Dissolved Oxygen Profile for the Waveland Site-August 15, 1983.

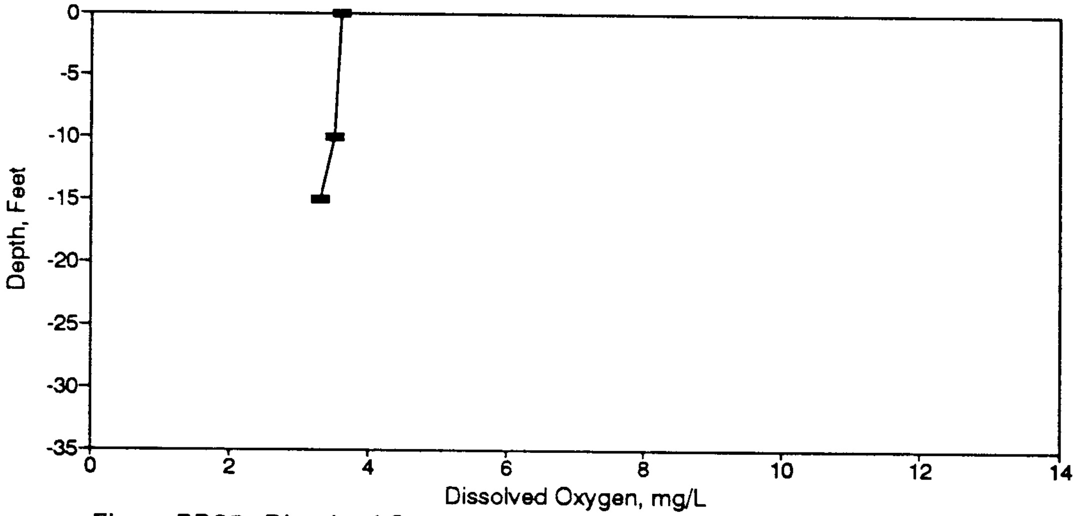

Figure BD35. Dissolved Oxygen Profile for the Waveland Site-September 14, 1983.

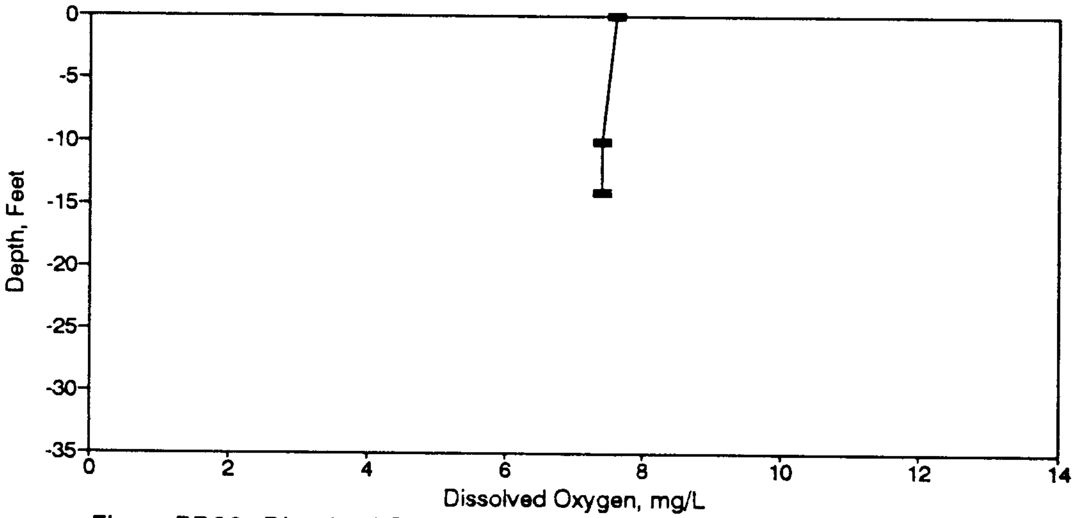

Figure BD36. Dissolved Oxygen Profile for the Waveland Site-October 14, 1983.

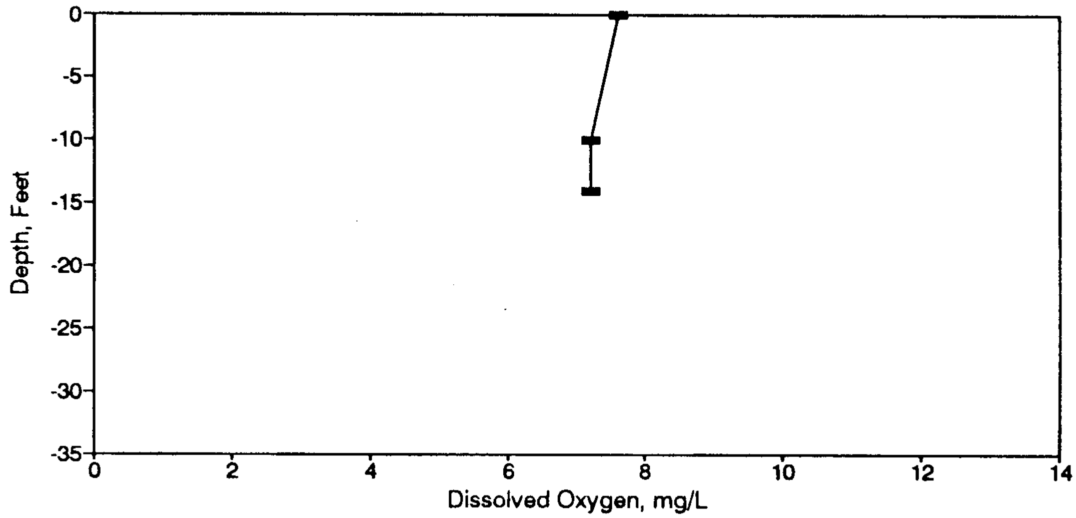

Figure BD37. Dissolved Oxygen Profile for the Waveland Site-November 1, 1983.

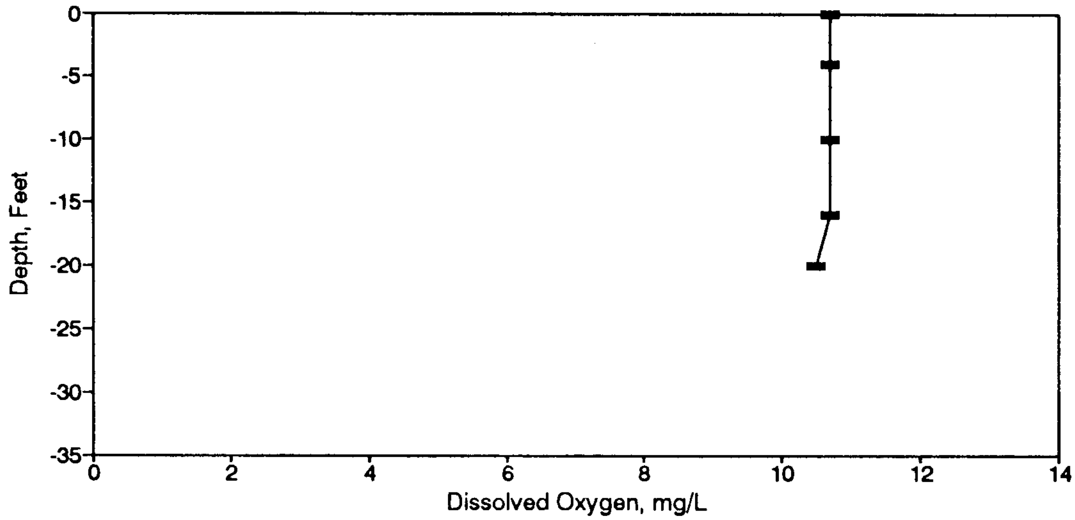

Figure BD38. Dissolved Oxygen Profile for the Waveland Site-December 5, 1983.

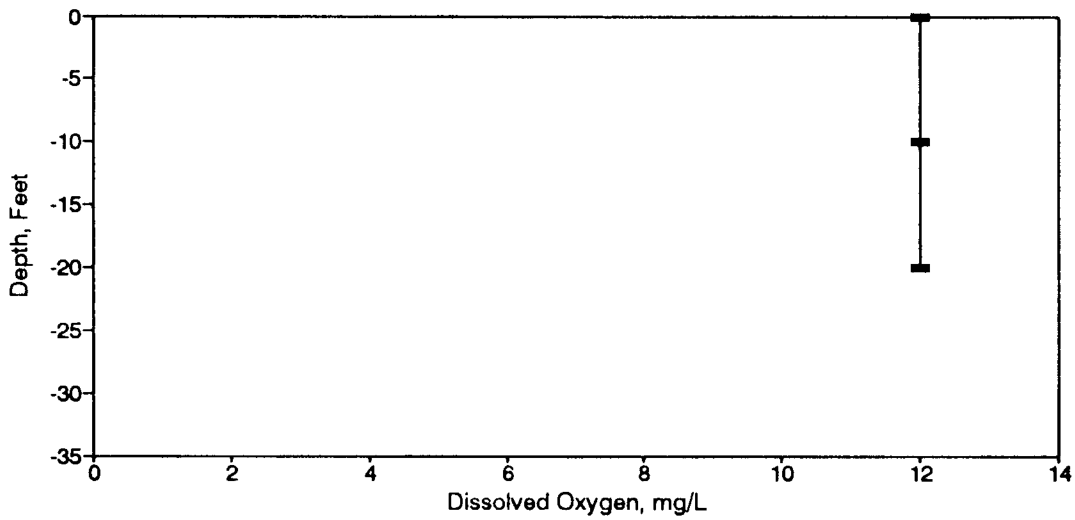

Figure BD39. Dissolved Oxygen Profile for the Waveland Site-January 12, 1984.

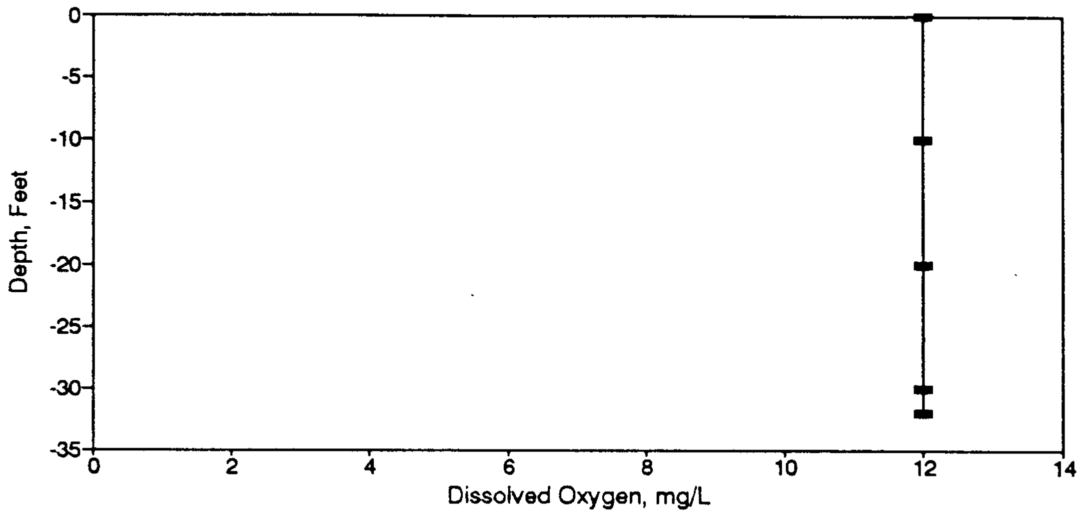

Figure BD40. Dissolved Oxygen Profile for the Waveland Site-February 6, 1984.

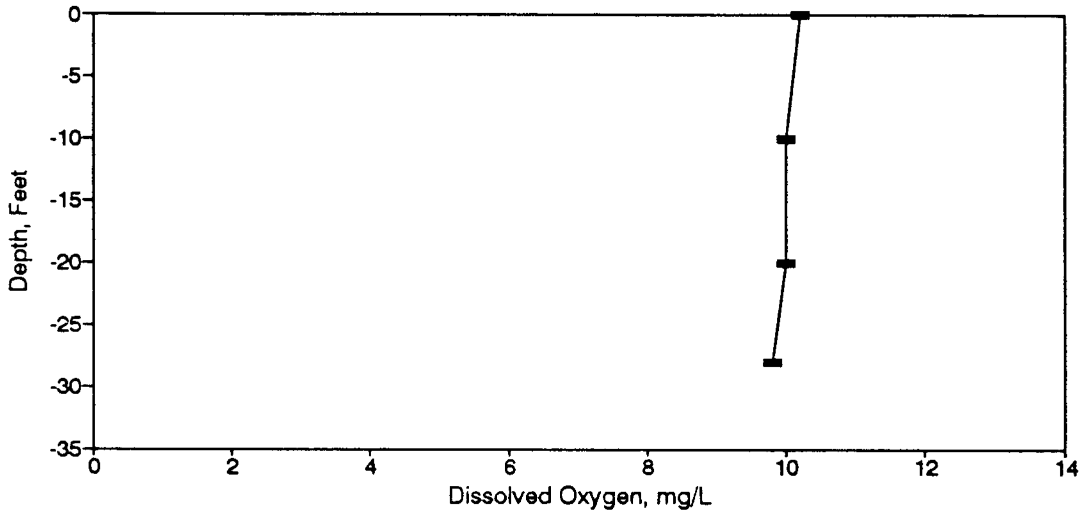

Figure BD41. Dissolved Oxygen Profile for the Waveland Site-March 19, 1984.

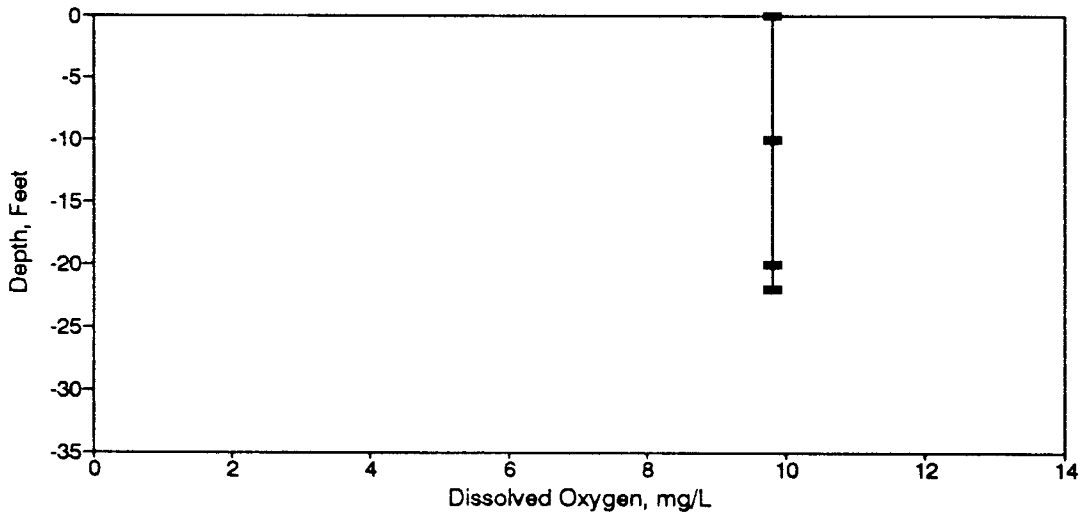

Figure BD42. Dissolved Oxygen Profile for the Waveland Site-April 9, 1984.

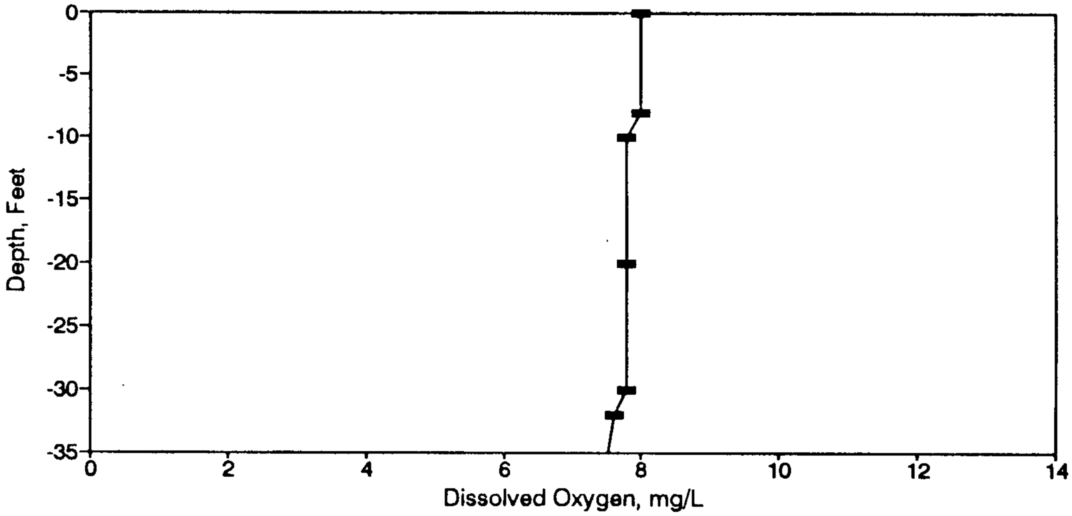

Figure BD43. Dissolved Oxygen Profile for the Waveland Site-May 8, 1984.

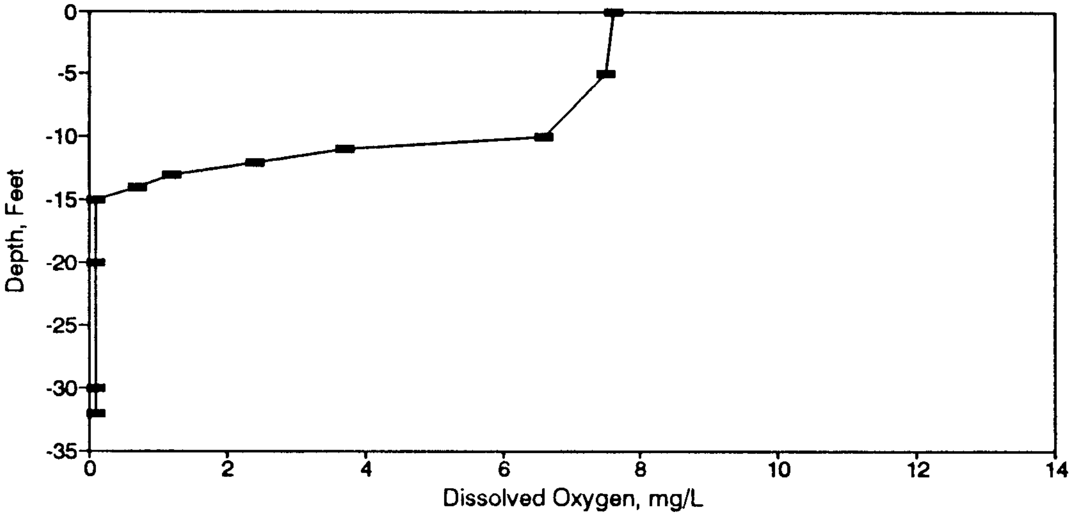

Figure BD44. Dissolved Oxygen Profile for the Waveland Site-June 18, 1984.

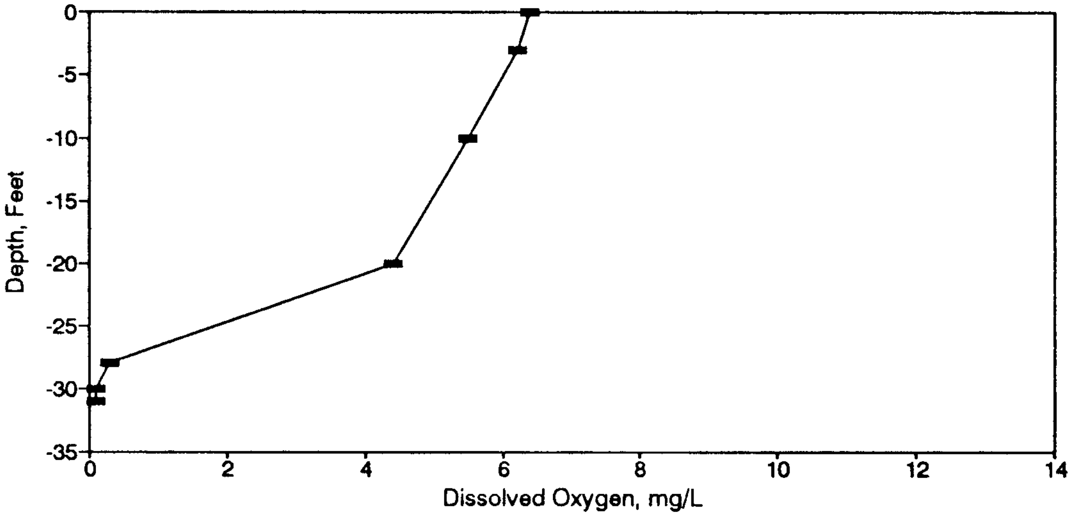

Figure BD45. Dissolved Oxygen Profile for the Waveland Site-July 23, 1984.

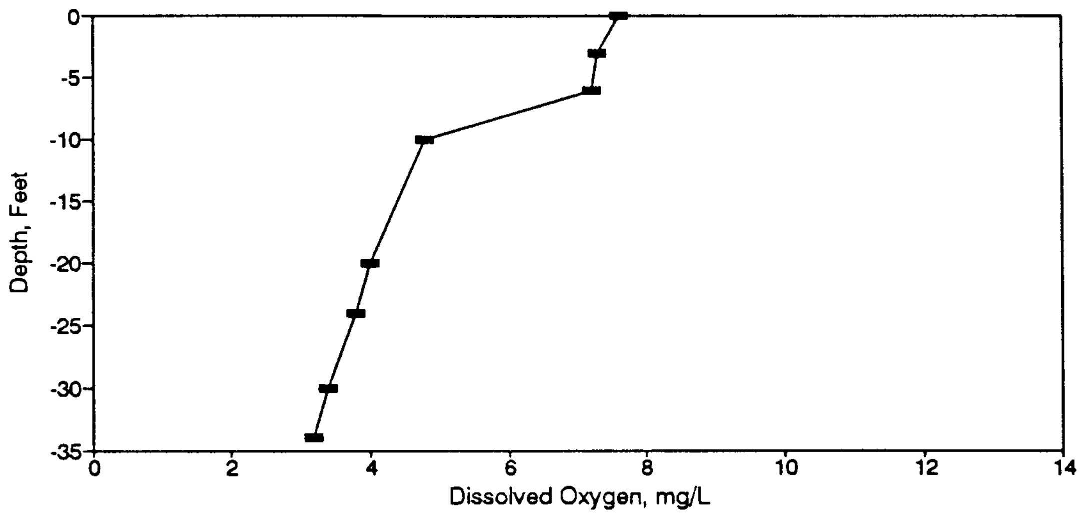

Figure BD46. Dissolved Oxygen Profile for the Waveland Site-August 27, 1984.

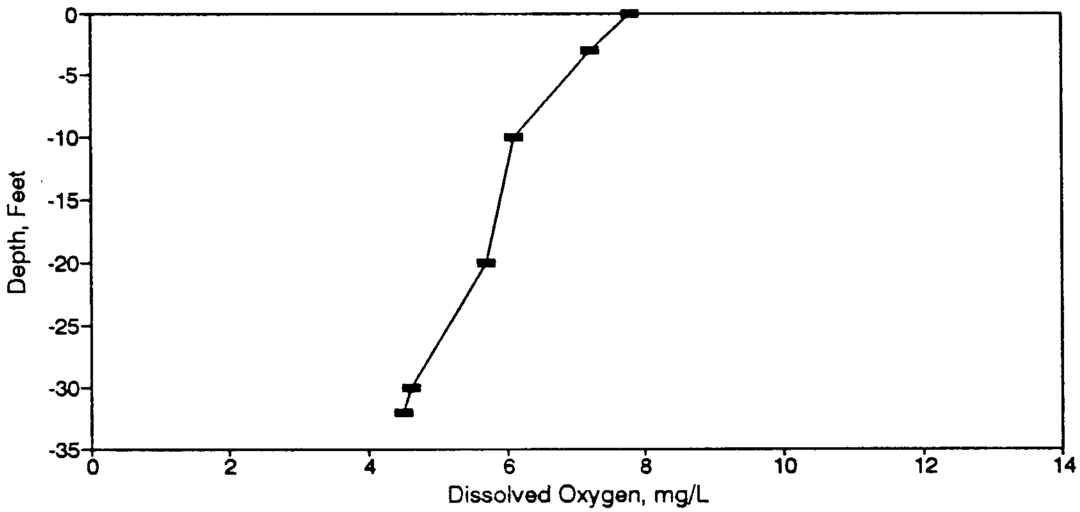

Figure BD47. Dissolved Oxygen Profile for the Waveland Site-September 24, 1984.

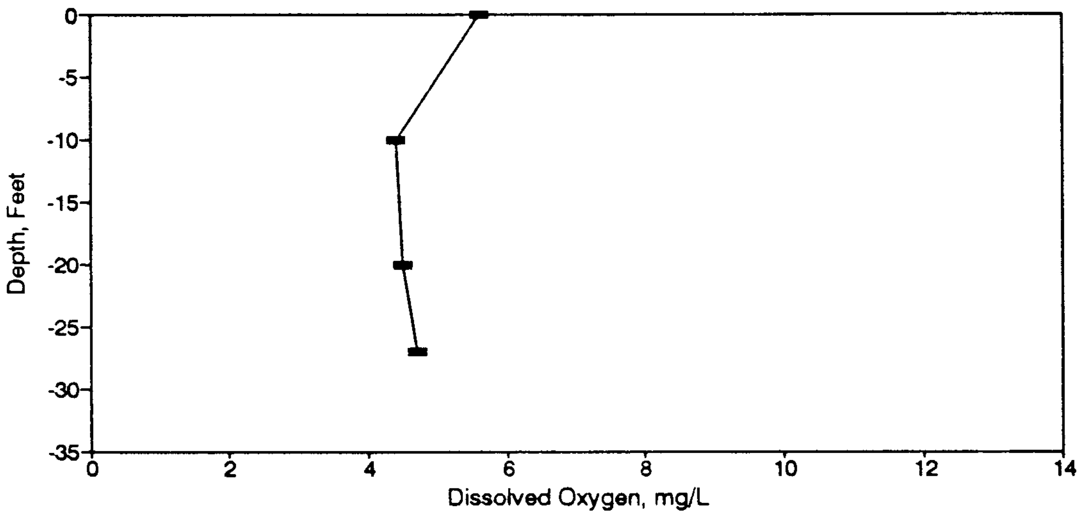

Figure BD48. Dissolved Oxygen Profile for the Waveland Site-October 11, 1984.

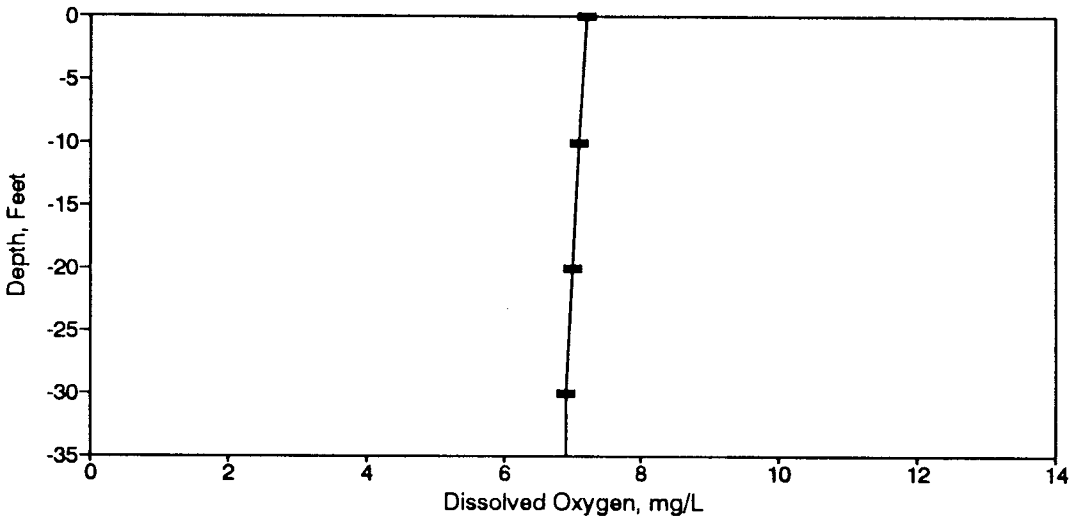

Figure BD49. Dissolved Oxygen Profile for the Waveland Site-November 21, 1984.

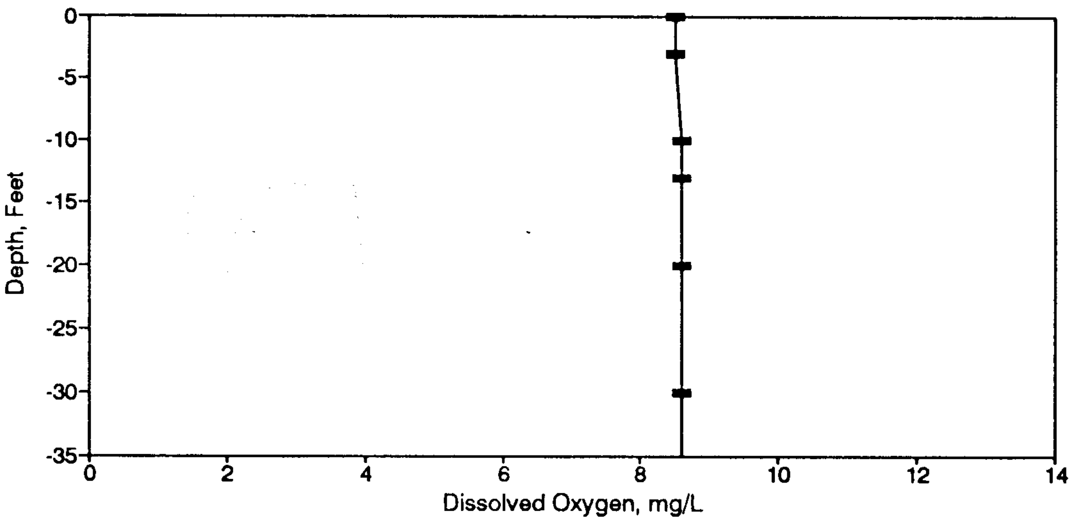

Figure BD50. Dissolved Oxygen Profile for the Waveland Site-December 20, 1984.

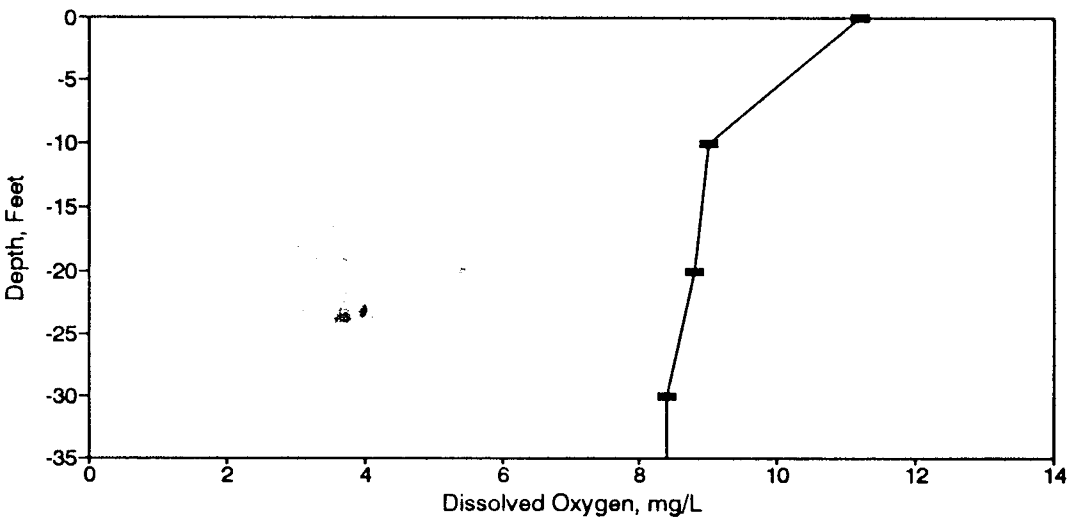

Figure BD51. Dissolved Oxygen Profile for the Waveland Site-February 26, 1985.

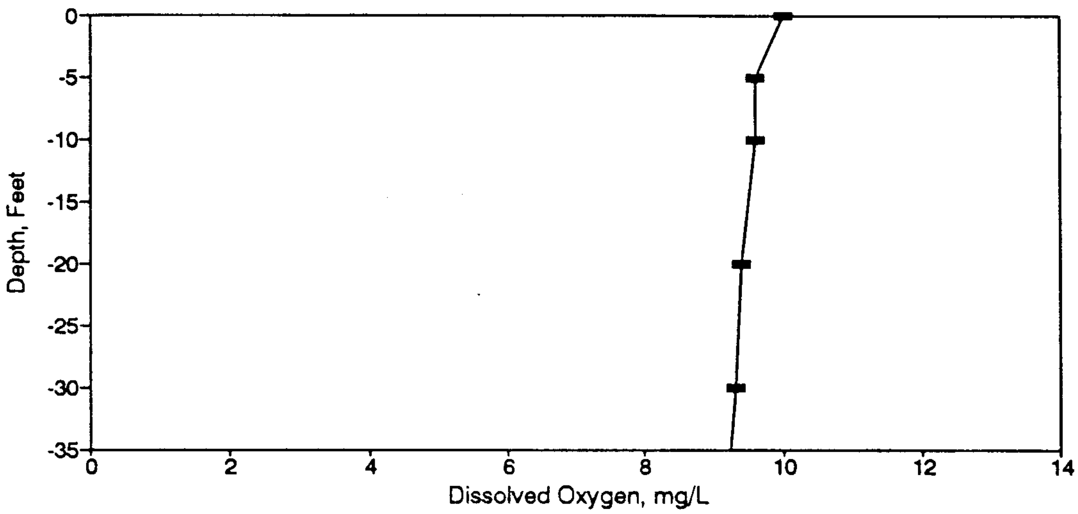

Figure BD52. Dissolved Oxygen Profile for the Waveland Site-March 19, 1985.

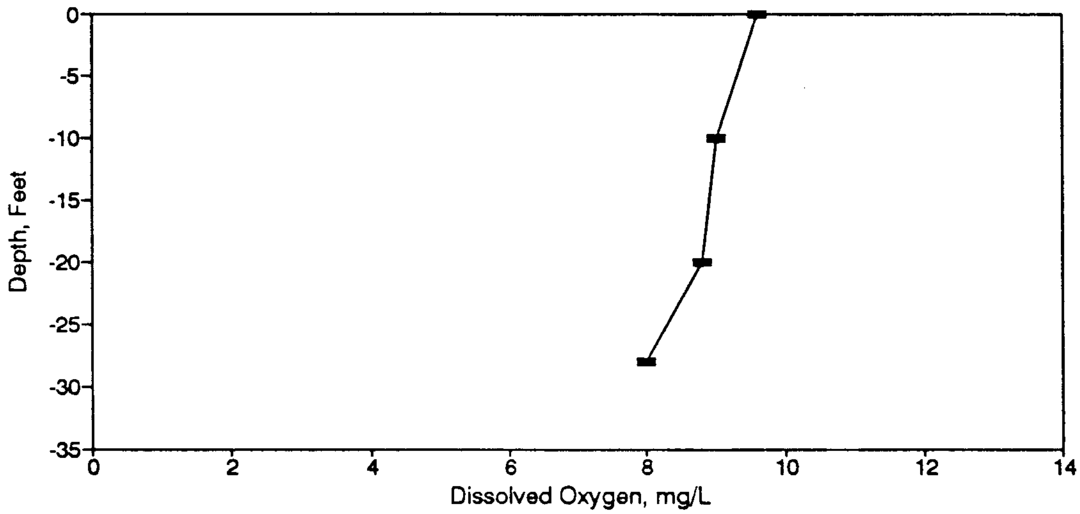

Figure BD53. Dissolved Oxygen Profile for the Waveland Site-April 23, 1985.

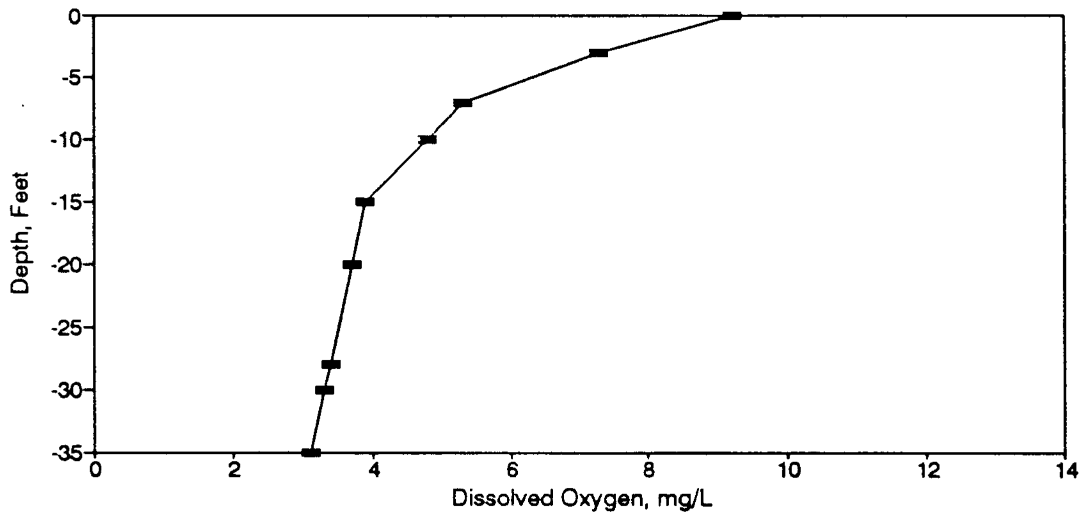

Figure BD54. Dissolved Oxygen Profile for the Waveland Site-May 28, 1985.

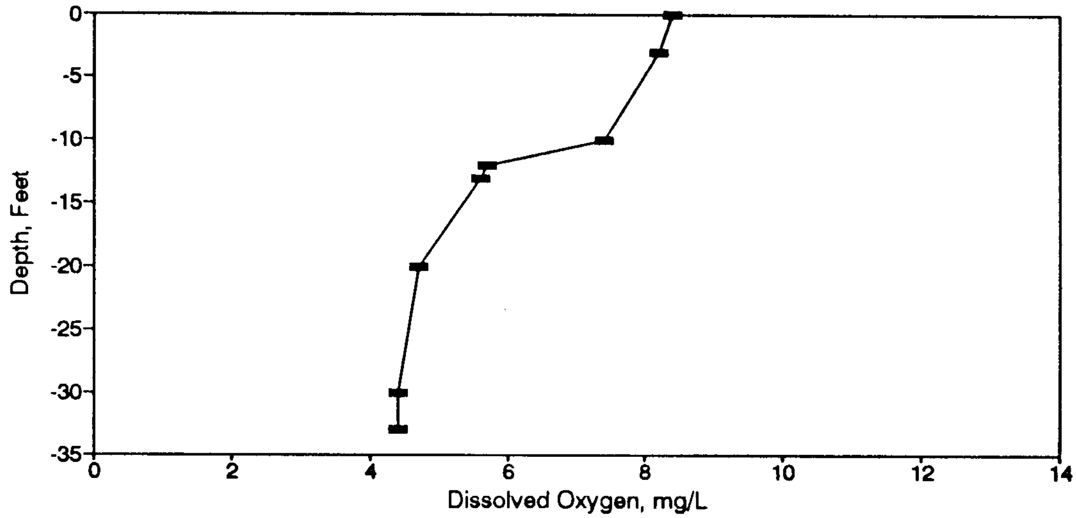

Figure BD55. Dissolved Oxygen Profile for the Waveland Site-June 17, 1985.

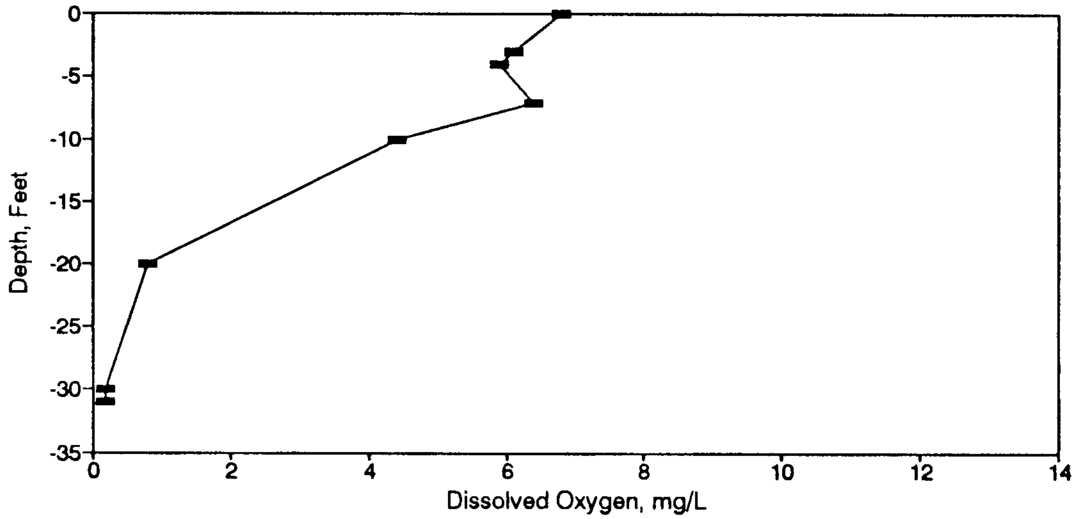

Figure BD56. Dissolved Oxygen Profile for the Waveland Site-July 22, 1985.

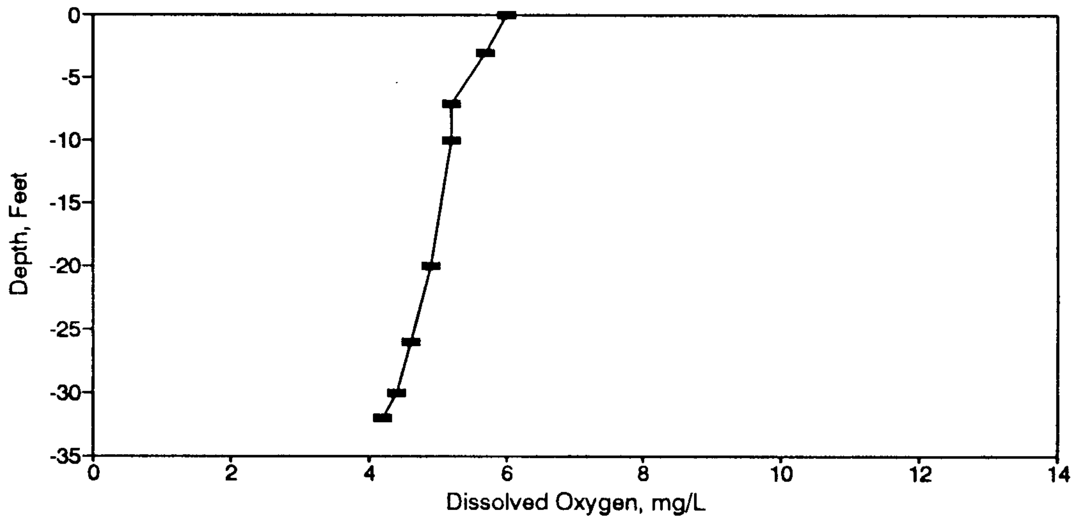

Figure BD57. Dissolved Oxygen Profile for the Waveland Site-August 23, 1985.

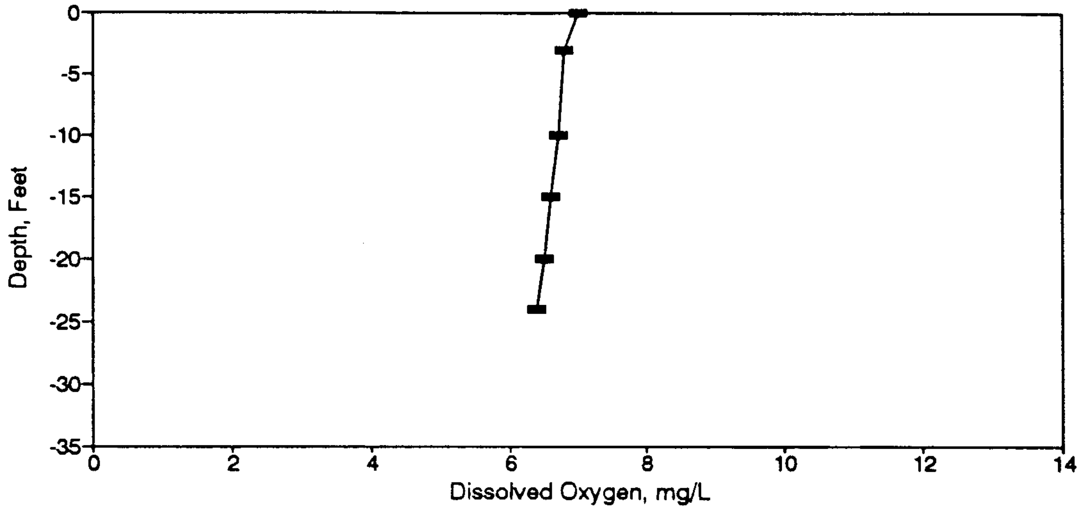

Figure BD58. Dissolved Oxygen Profile for the Waveland Site-September 23, 1985.

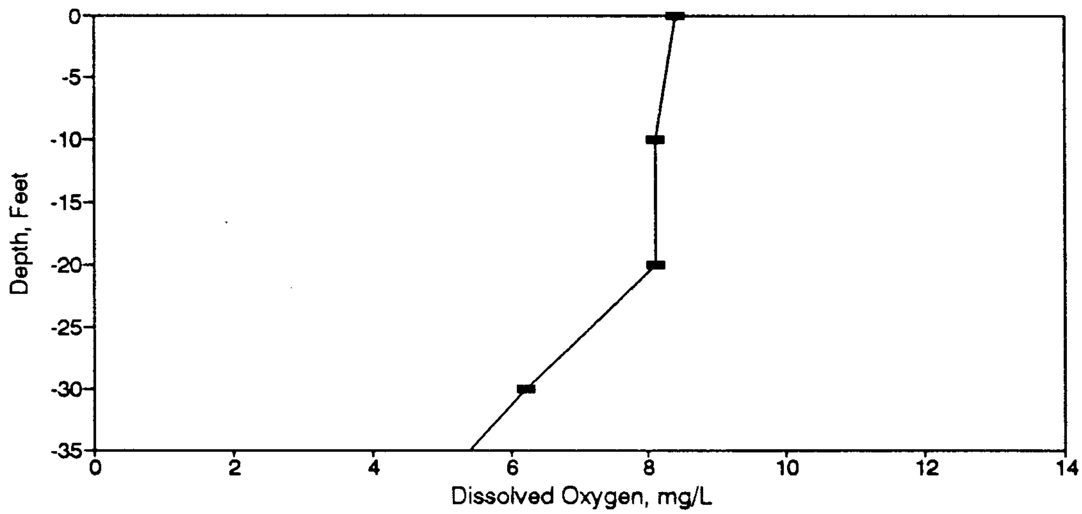

Figure BD59. Dissolved Oxygen Profile for the Waveland Site-October 16, 1985.

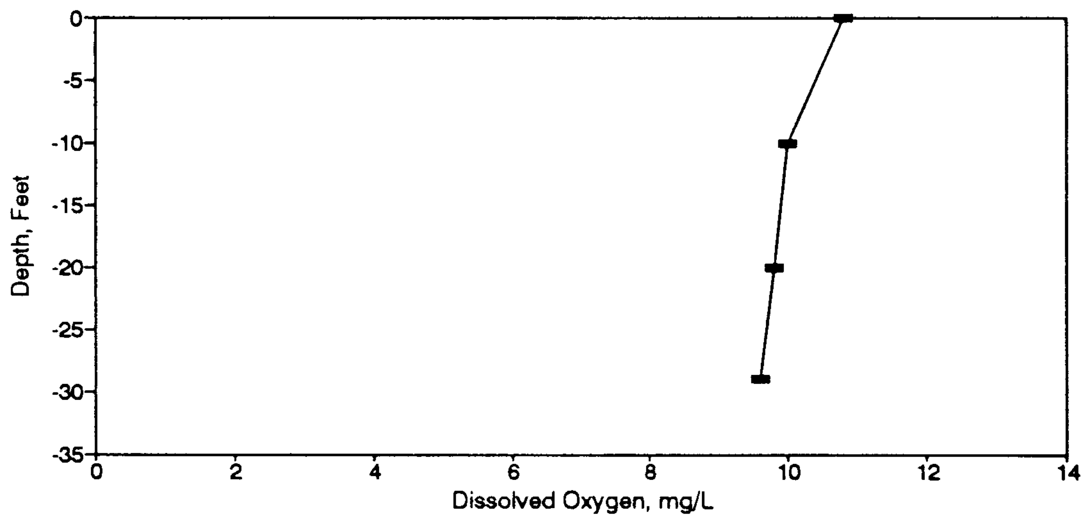

Figure BD60. Dissolved Oxygen Profile for the Waveland Site-November 18, 1985.

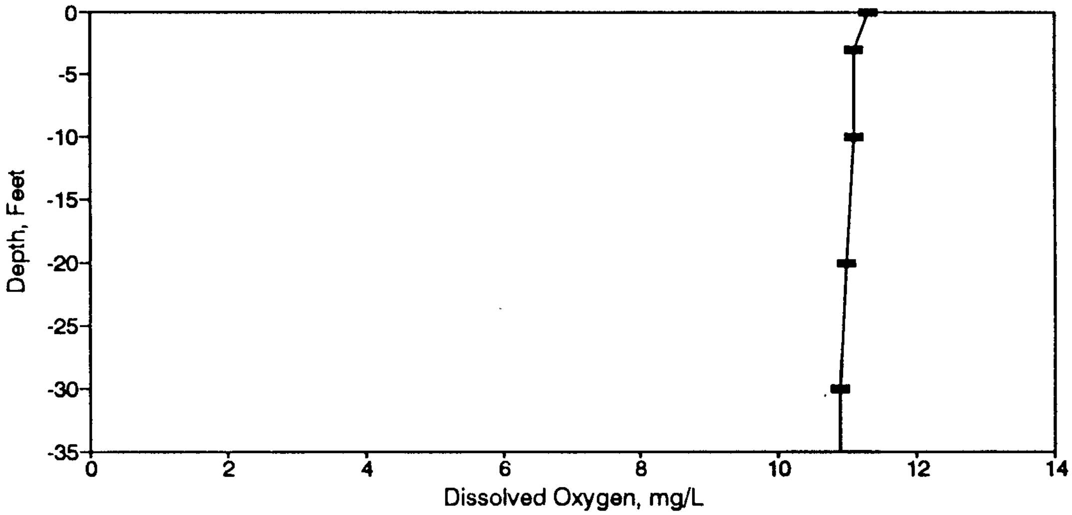

Figure BD61. Dissolved Oxygen Profile for the Waveland Site-December 12, 1985.

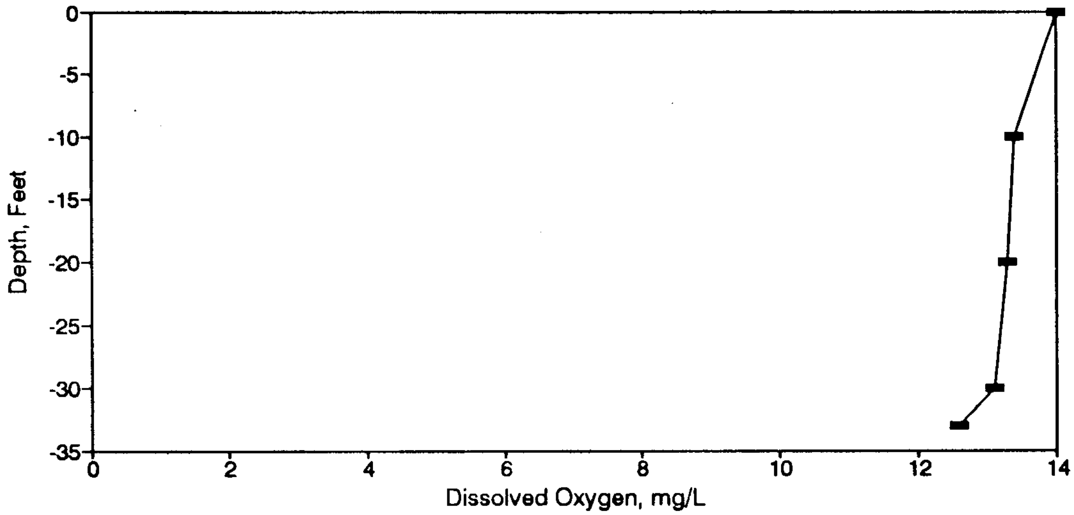

Figure BD62. Dissolved Oxygen Profile for the Waveland Site-January 14, 1986.

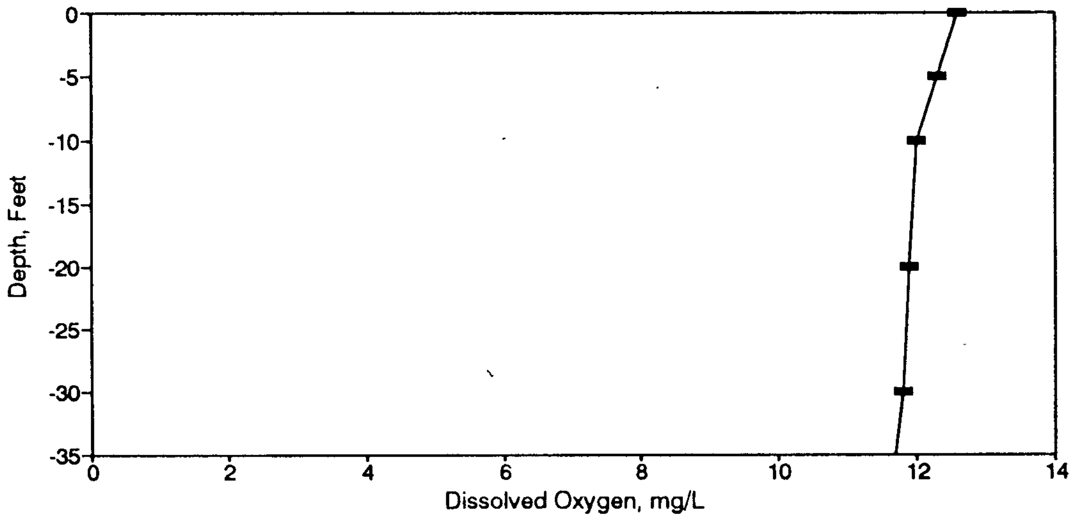

Figure BD63. Dissolved Oxygen Profile for the Waveland Site-February 3, 1986.

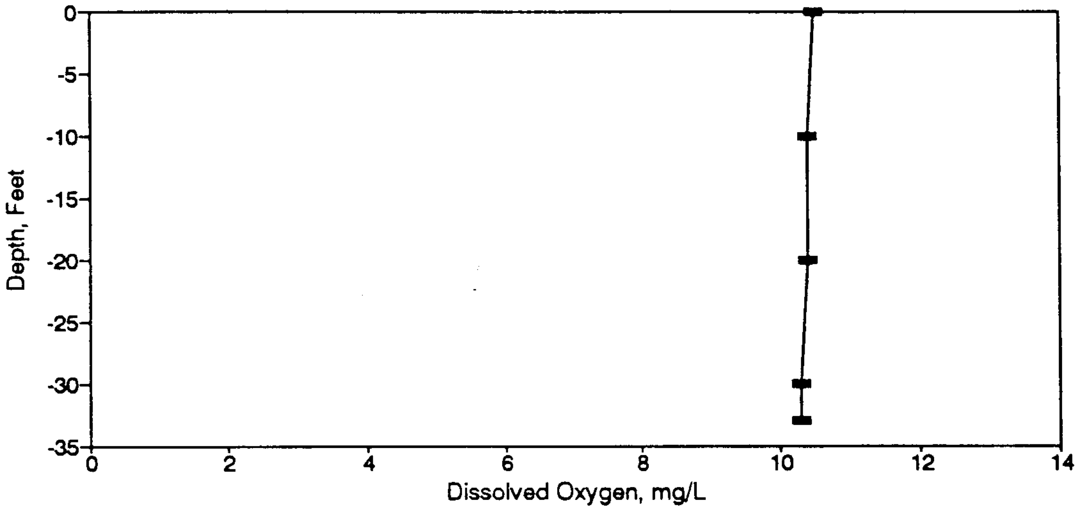

Figure BD64. Dissolved Oxygen Profile for the Waveland Site-March 11, 1986.

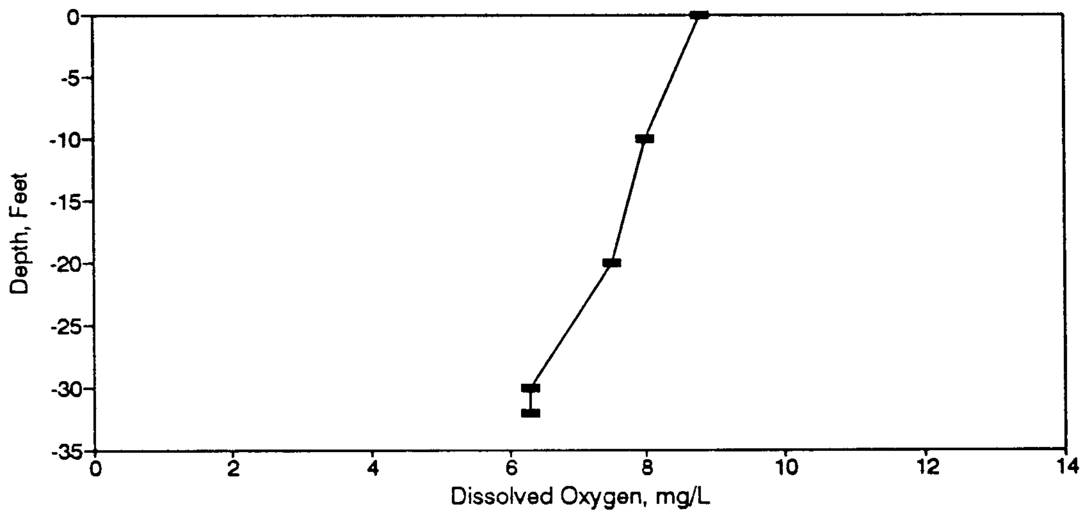

Figure BD65. Dissolved Oxygen Profile for the Waveland Site-April 14, 1986.

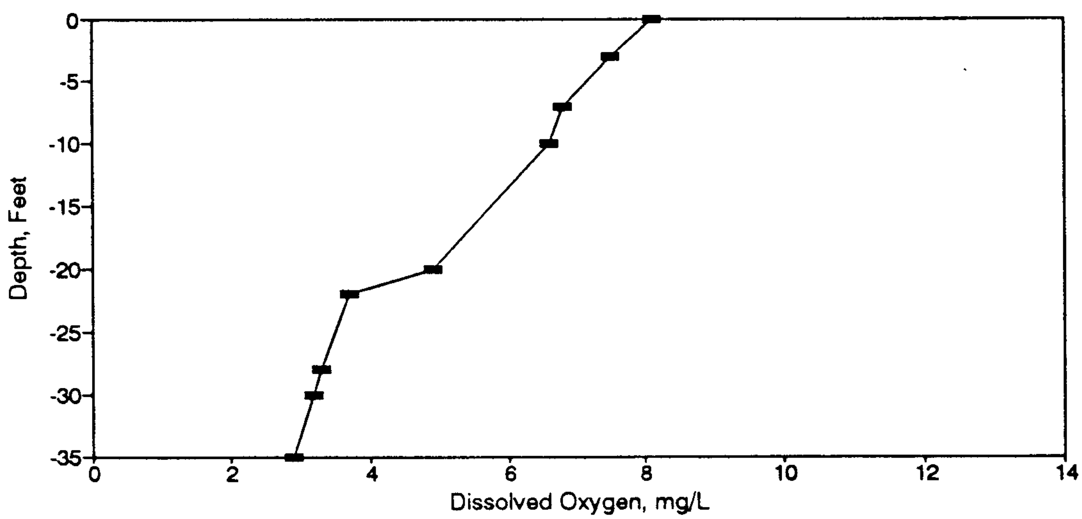

Figure BD66. Dissolved Oxygen Profile for the Waveland Site-May 15, 1986.

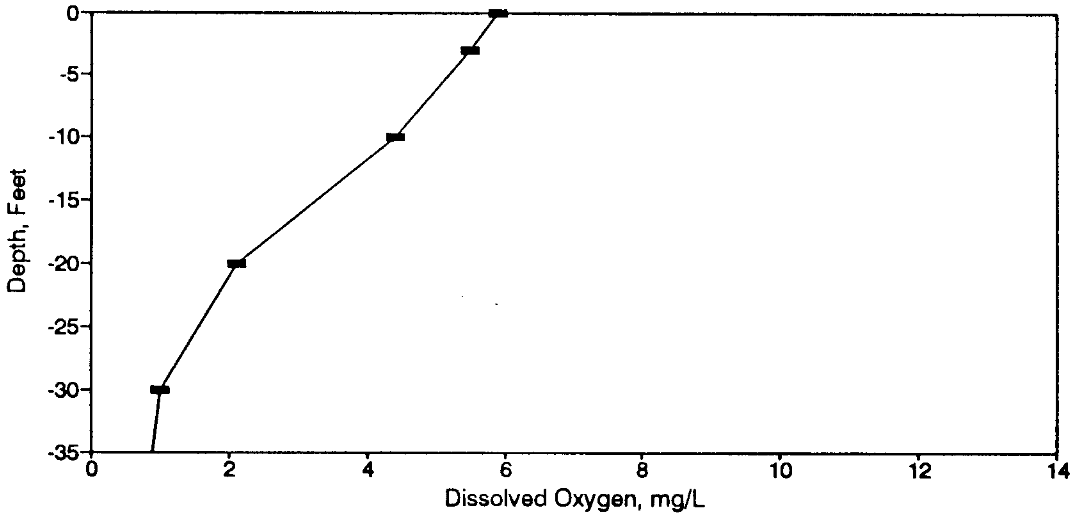

Figure BD67. Dissolved Oxygen Profile for the Waveland Site-June 9, 1986.

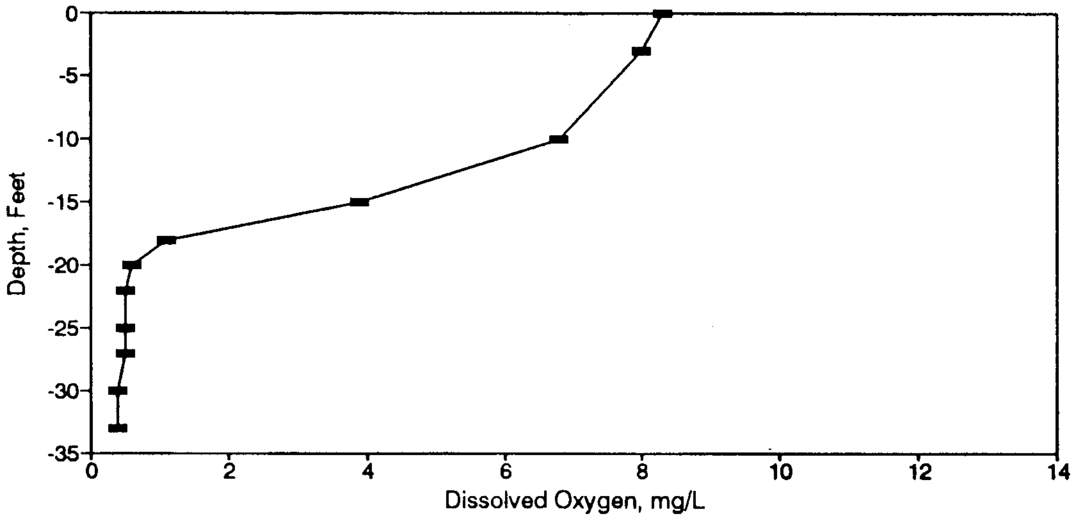

Figure BD68. Dissolved Oxygen Profile for the Waveland Site-July 15, 1986.

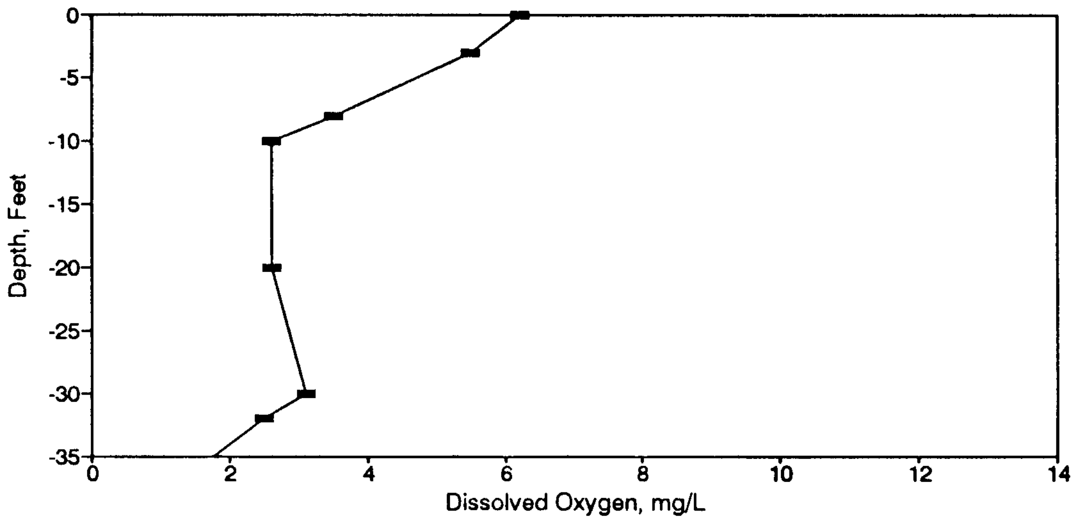

Figure BD69. Dissolved Oxygen Profile for the Waveland Site-August 21, 1986.

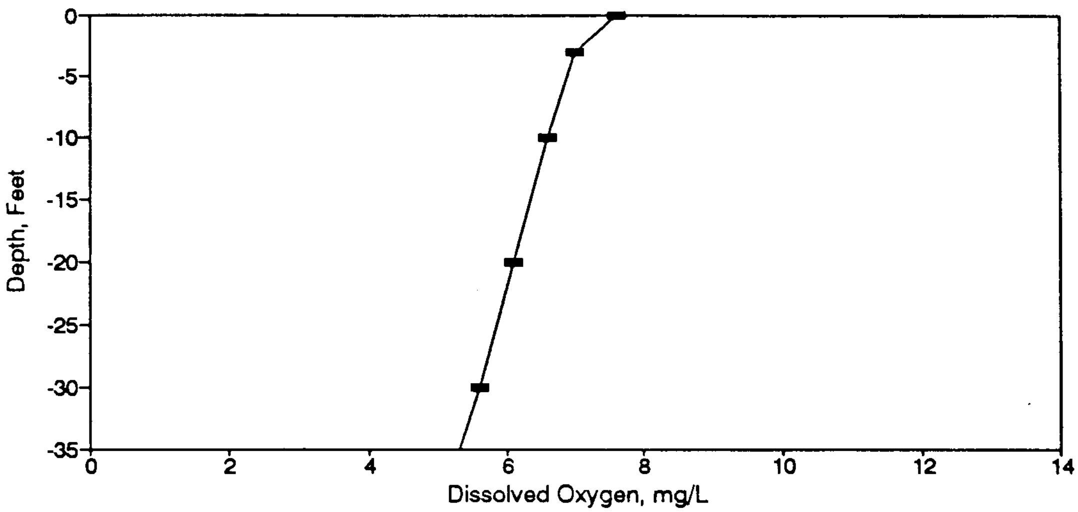

Figure BD70. Dissolved Oxygen Profile for the Waveland Site-September 10, 1986.

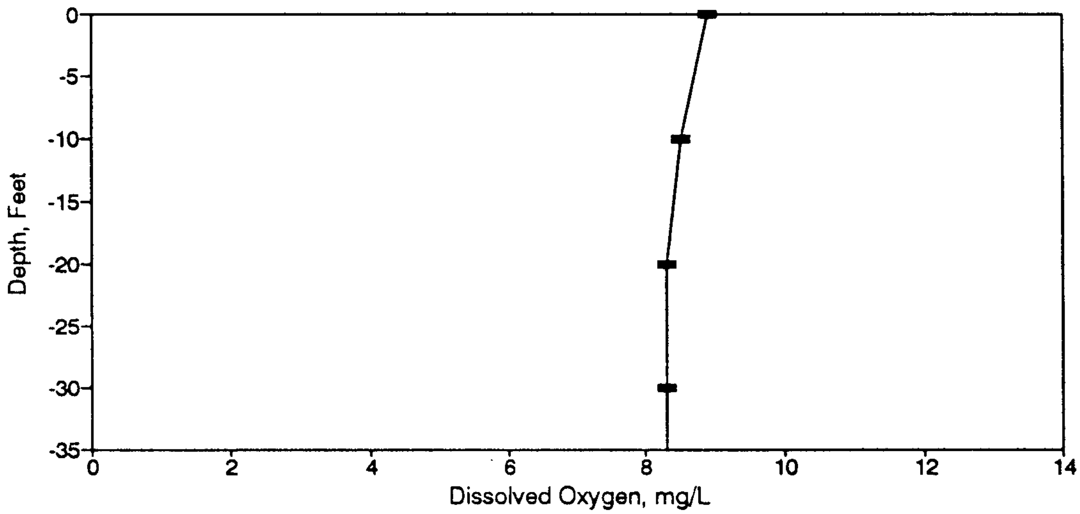

Figure BD71. Dissolved Oxygen Profile for the Waveland Site-October 14, 1986.

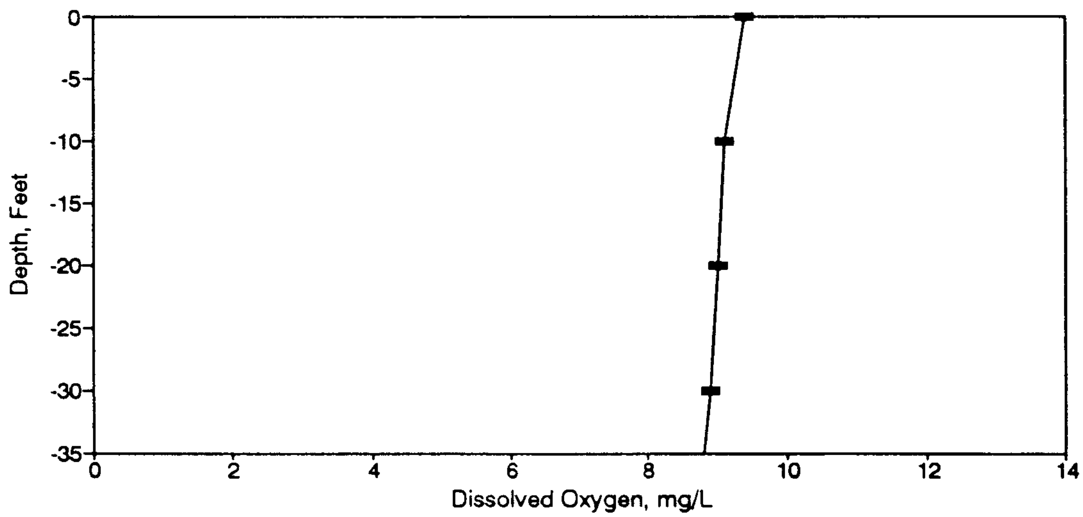

Figure BD72. Dissolved Oxygen Profile for the Waveland Site-November 3, 1986.

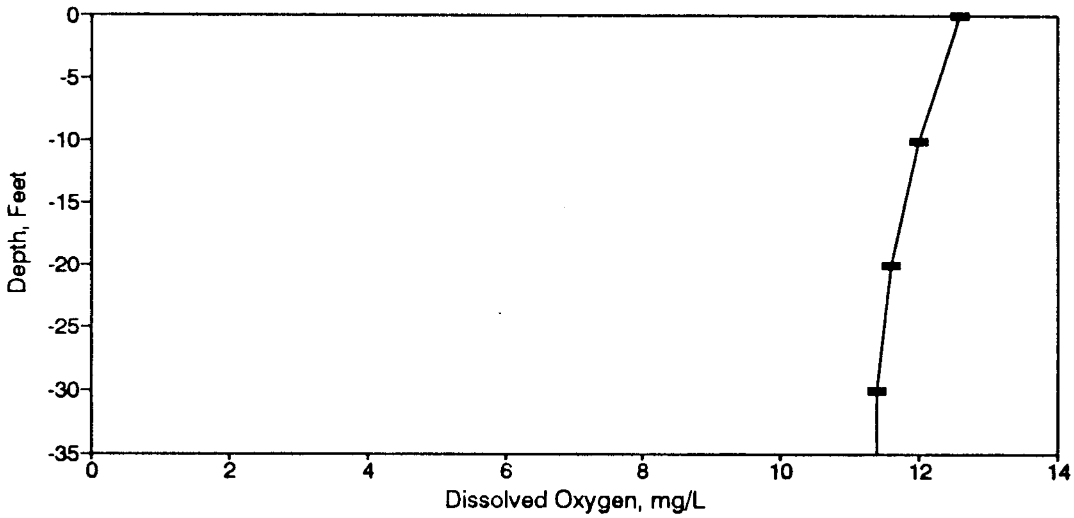

Figure BD73. Dissolved Oxygen Profile for the Waveland Site-December 8, 1986.

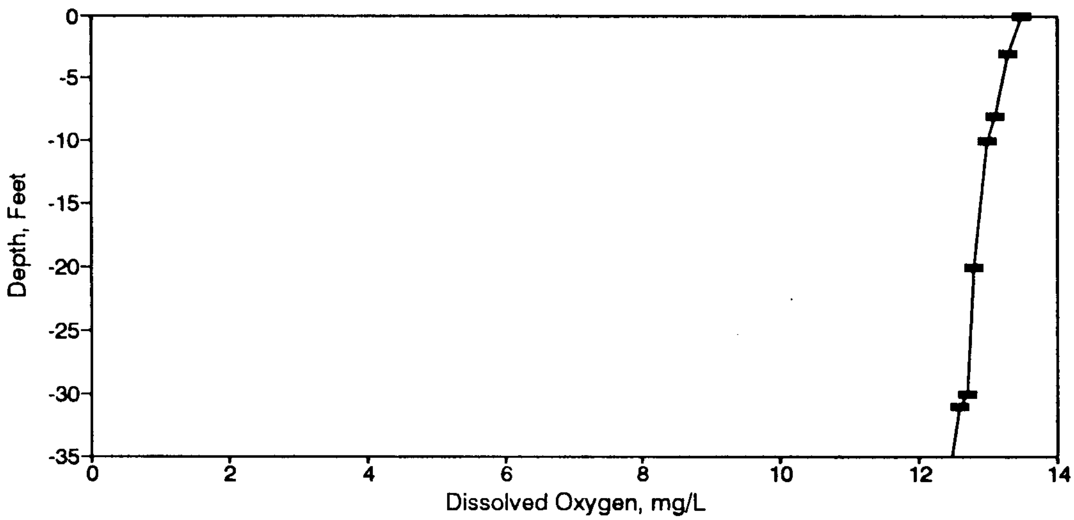

Figure BD74. Dissolved Oxygen Profile for the Waveland Site-January 15, 1987.

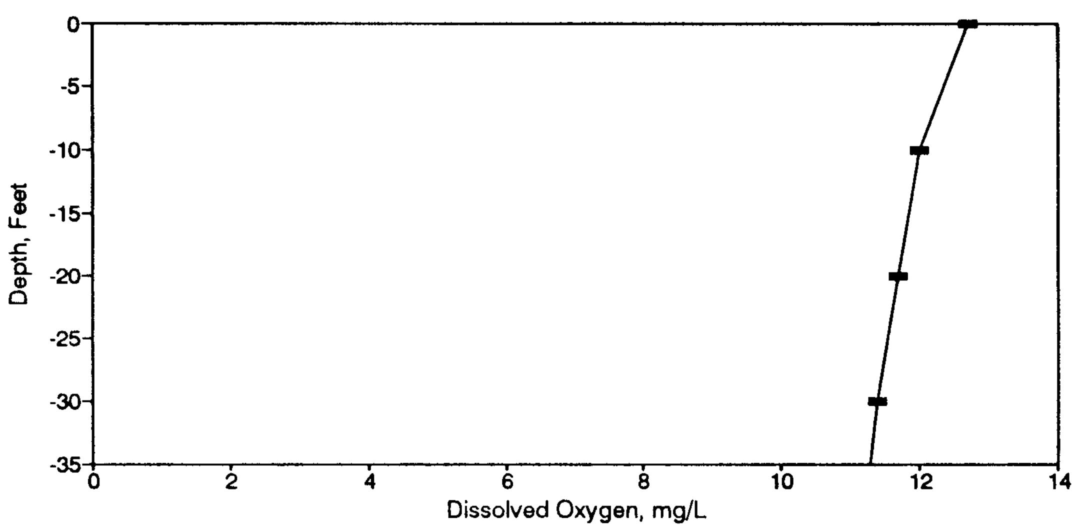

Figure BD75. Dissolved Oxygen Profile for the Waveland Site-February 10, 1987.

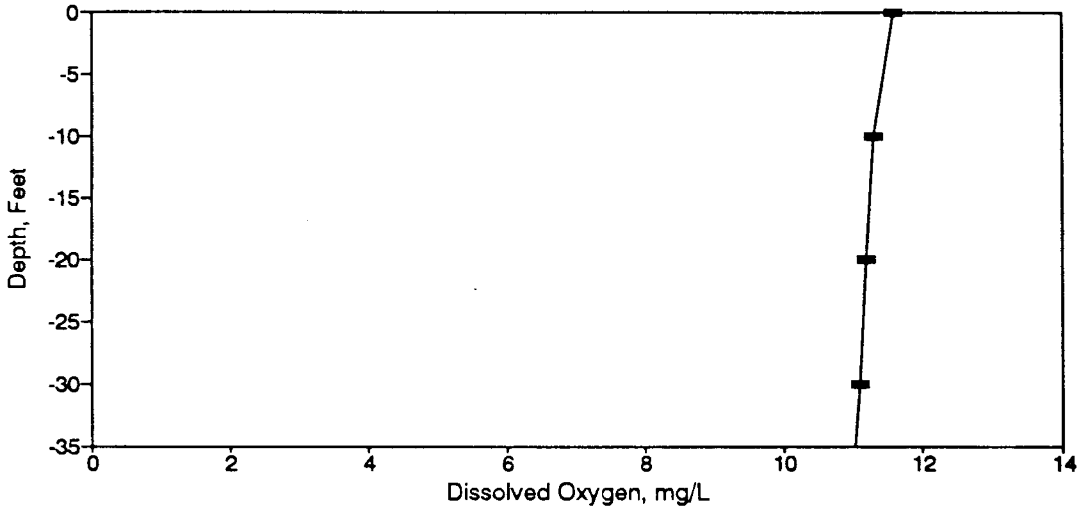

Figure BD76. Dissolved Oxygen Profile for the Waveland Site-March 2, 1987.

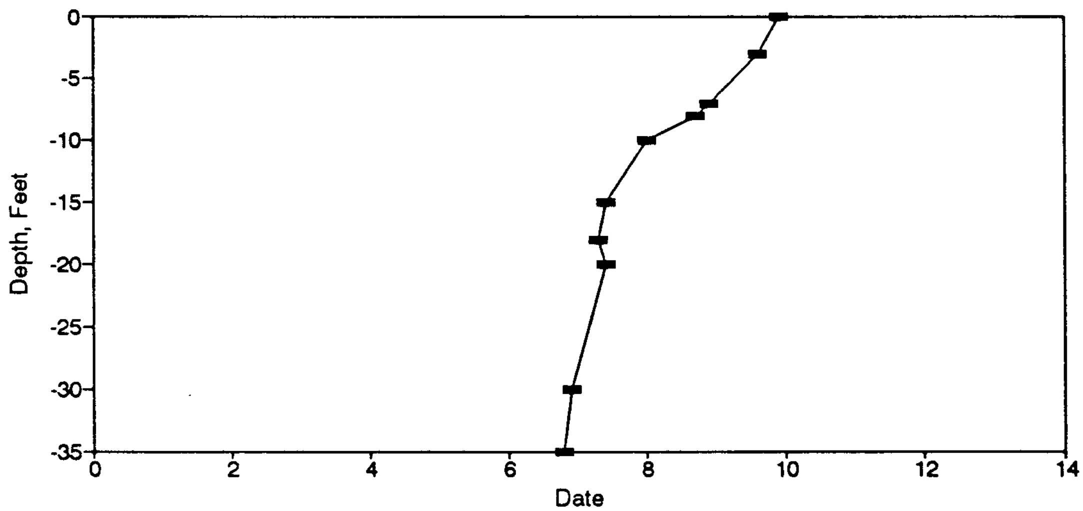

Figure BD77. Dissolved Oxygen Profile for the Waveland Site-April 30, 1987.

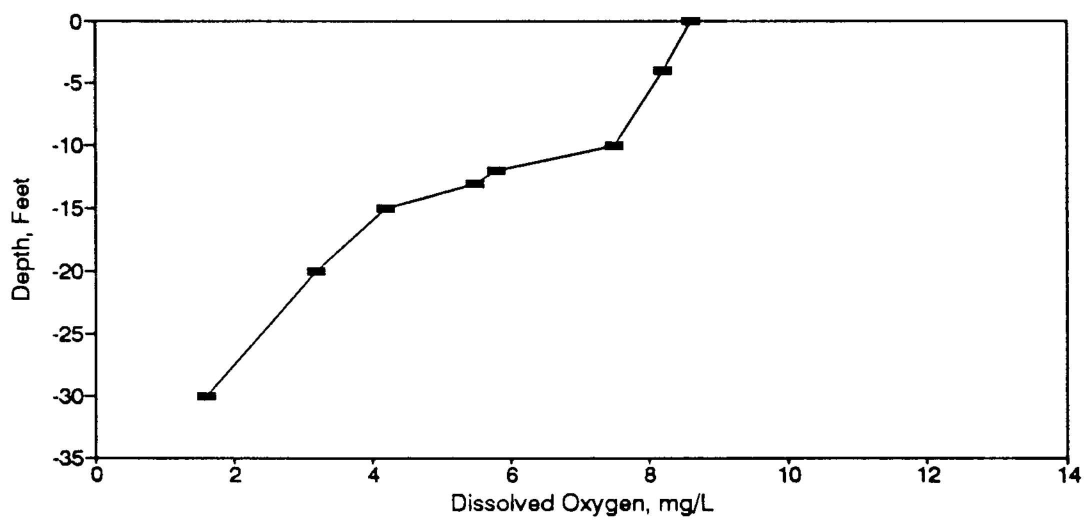

Figure BD78. Dissolved Oxygen Profile for the Waveland Site-May 15, 1987.

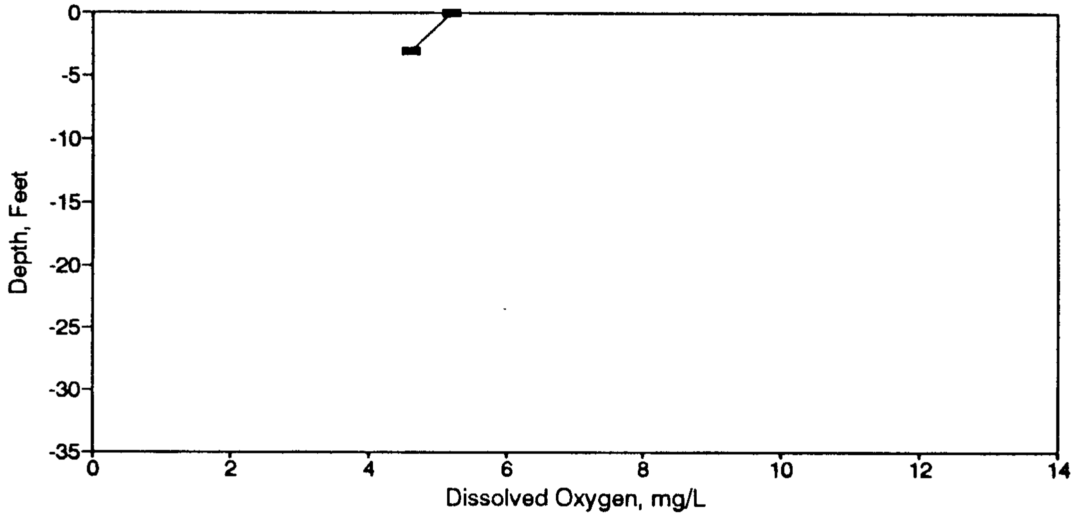

Figure BD79. Dissolved Oxygen Profile for the Waveland Site-June 1, 1987.

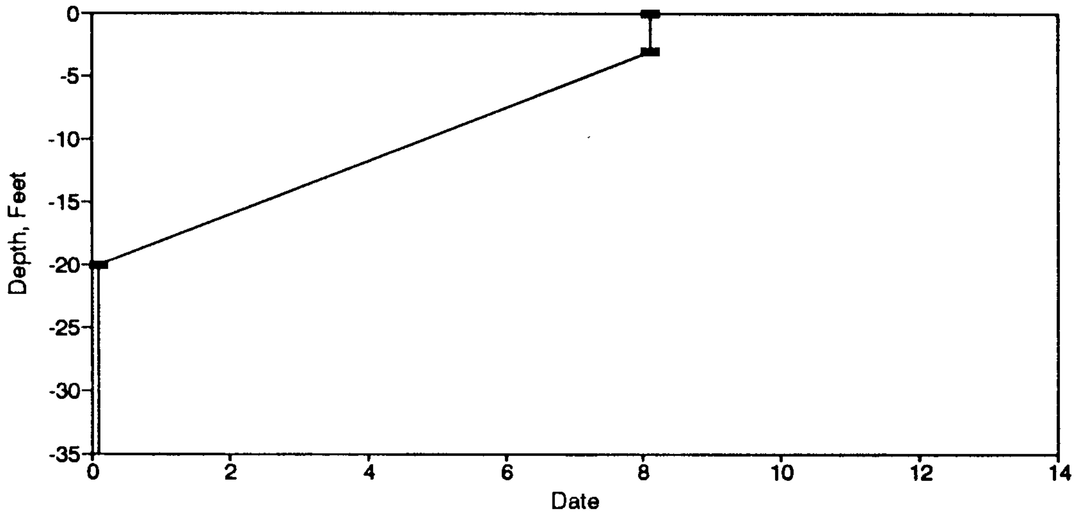

Figure BD80. Dissolved Oxygen Profile for the Waveland Site-July 6, 1987.

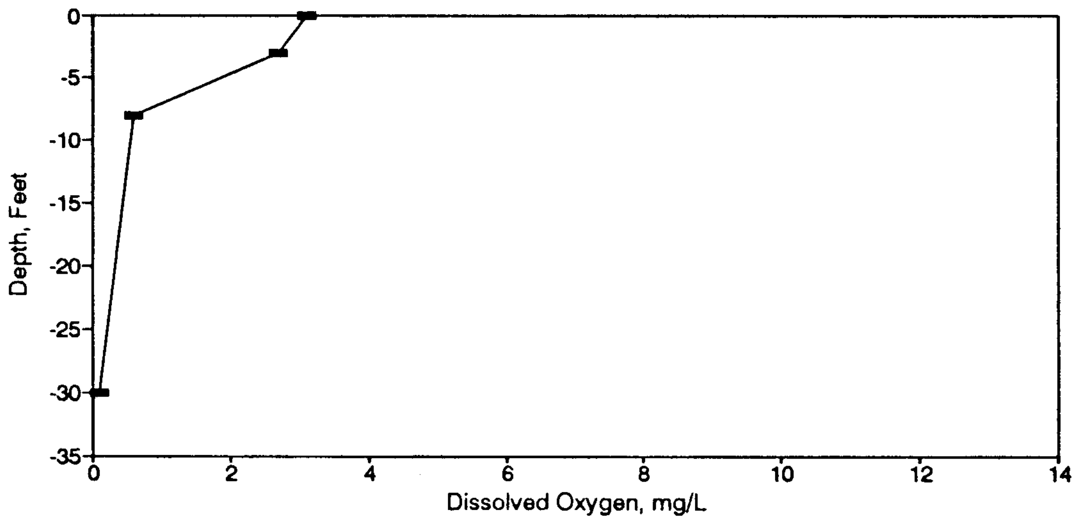

Figure BD81. Dissolved Oxygen Profile for the Waveland Site-August 6, 1987.

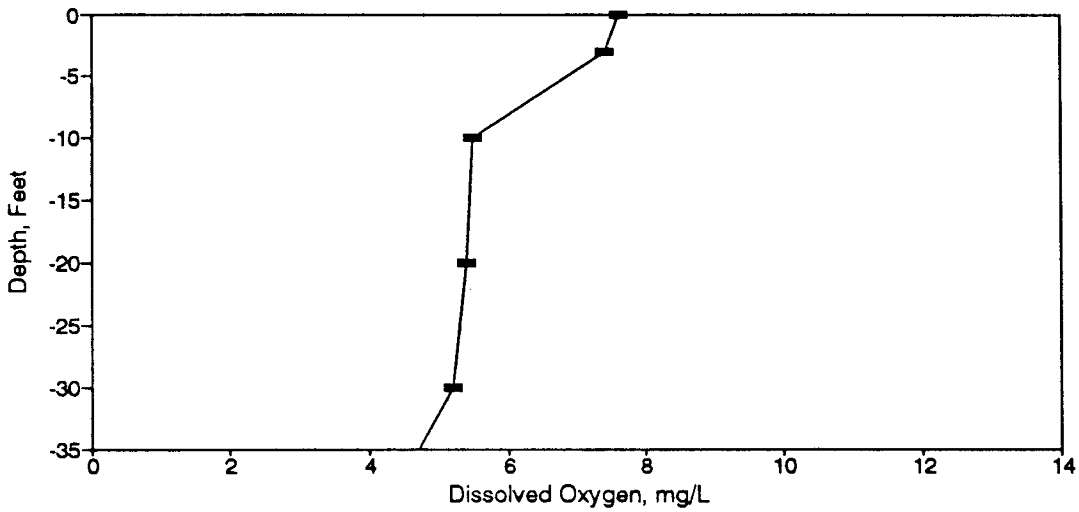

Figure BD82. Dissolved Oxygen Profile for the Waveland Site-September 2, 1987.

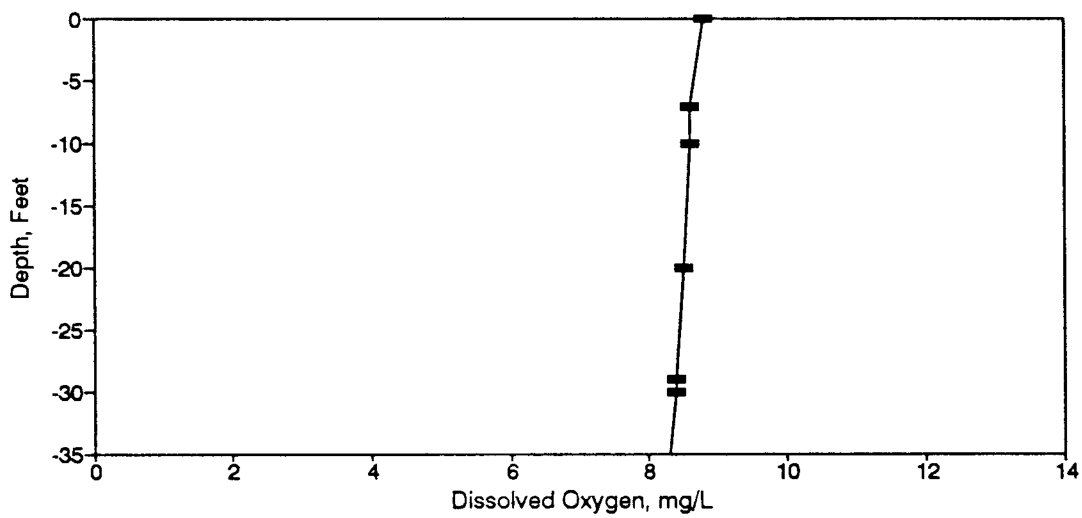

Figure BD83. Dissolved Oxygen Profile for the Waveland Site-October 6, 1987.

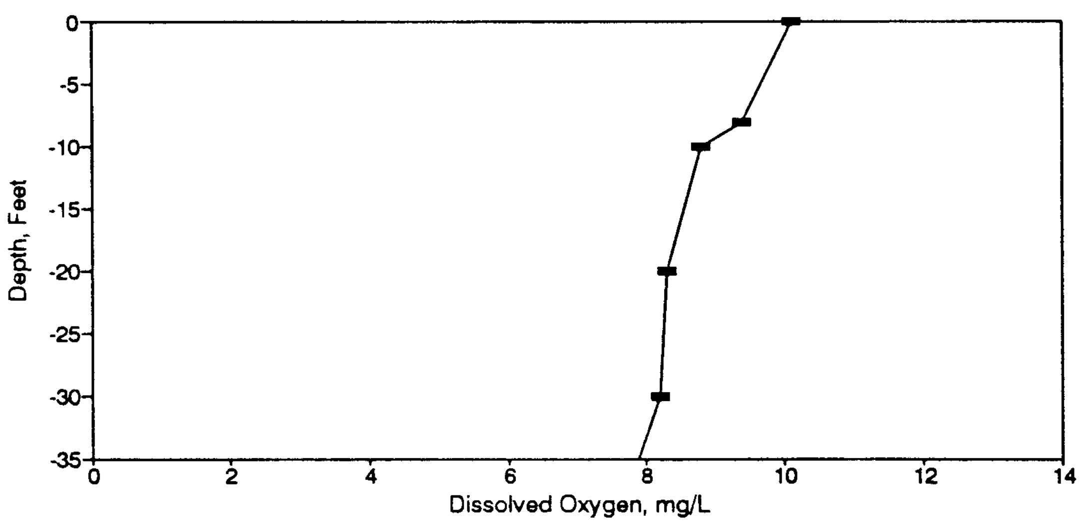

Figure BD84. Dissolved Oxygen Profile for the Waveland Site-November 2, 1987.

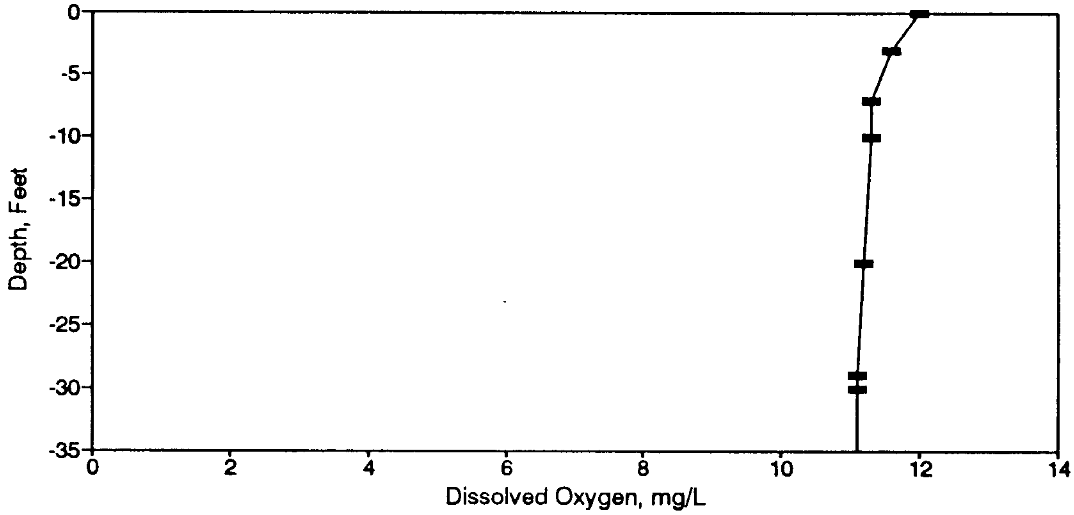

Figure BD85. Dissolved Oxygen Profile for the Waveland Site-December 3, 1987.

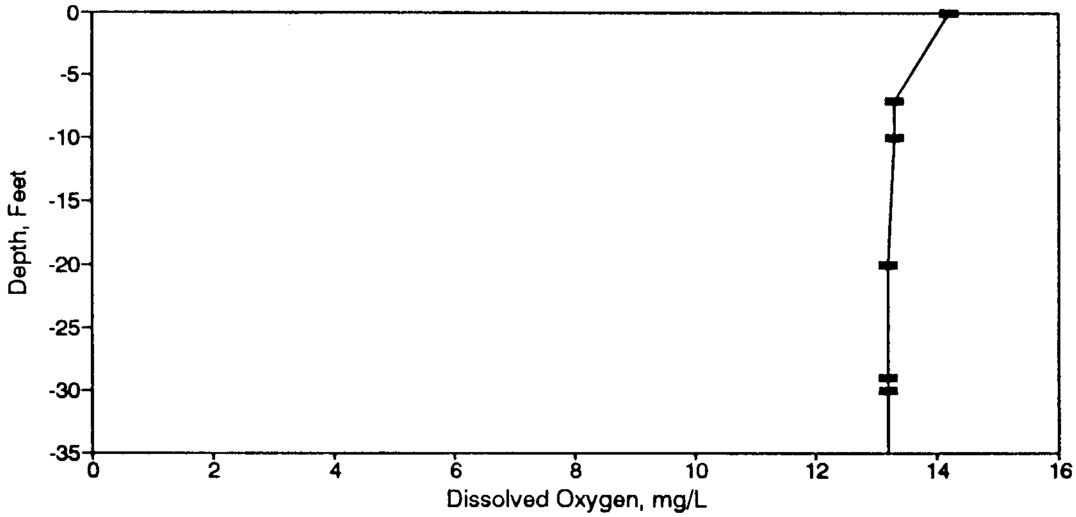

Figure BD86. Dissolved Oxygen Profile for the Waveland Site-January 25, 1988.

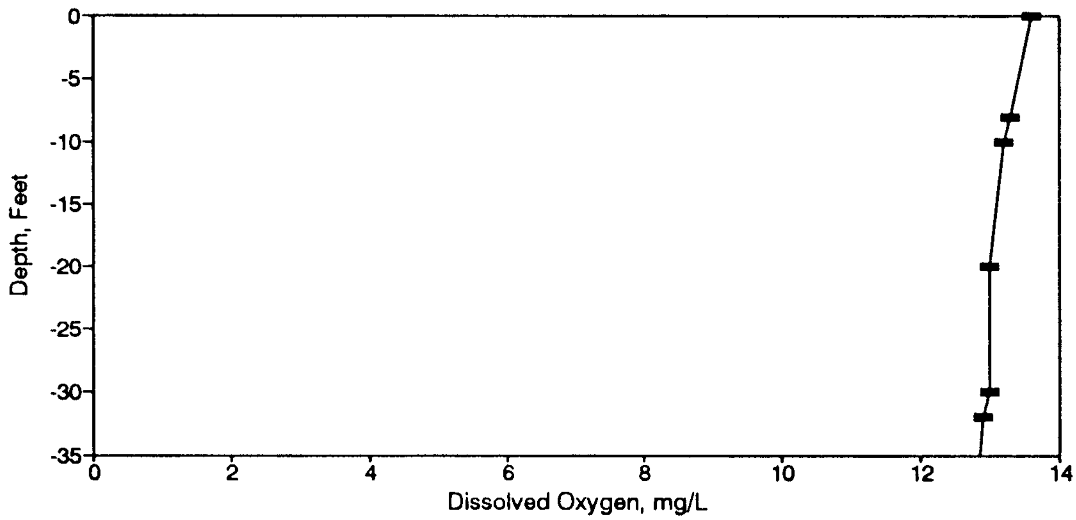

Figure BD87. Dissolved Oxygen Profile for the Waveland Site-February 16, 1988.

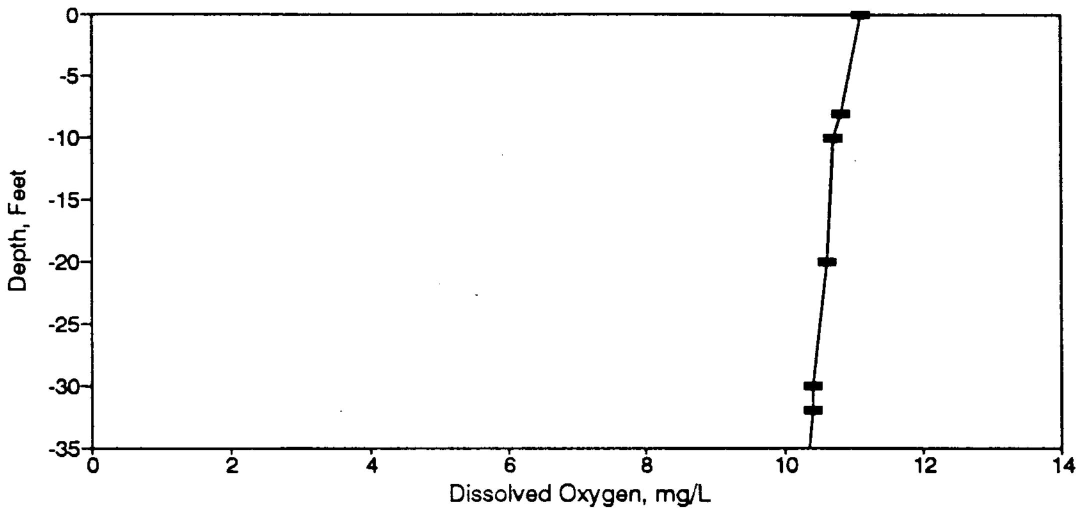

Figure BD88. Dissolved Oxygen Profile for the Waveland Site-March 9, 1988.

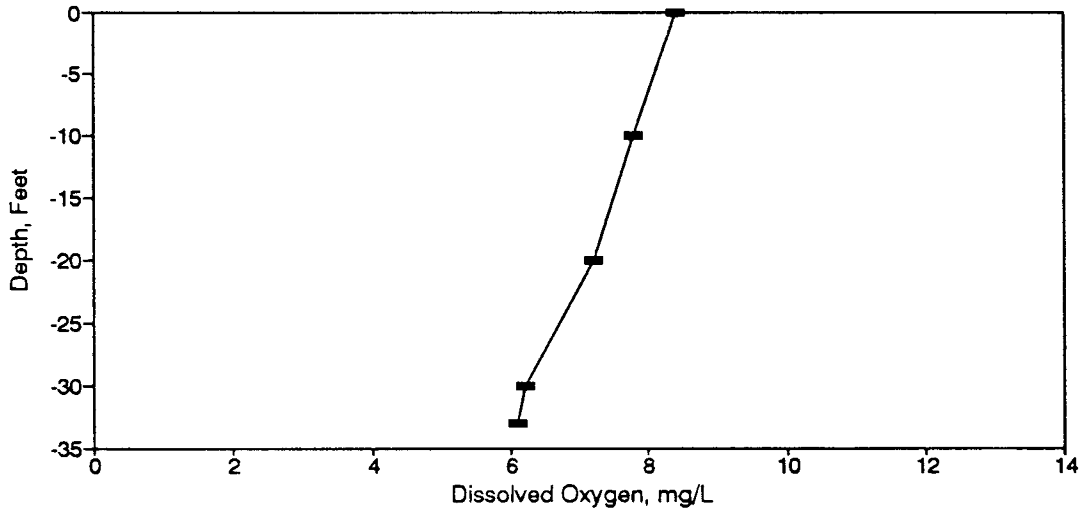

Figure BD89. Dissolved Oxygen Profile for the Waveland Site-April 25, 1988.

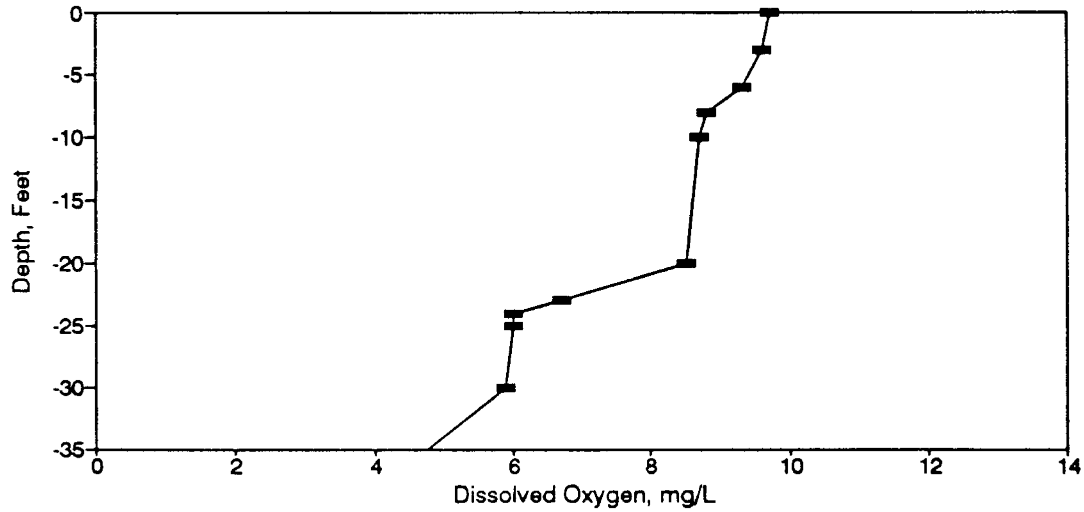

Figure BD90. Dissolved Oxygen Profile for the Waveland Site-May 12, 1988.

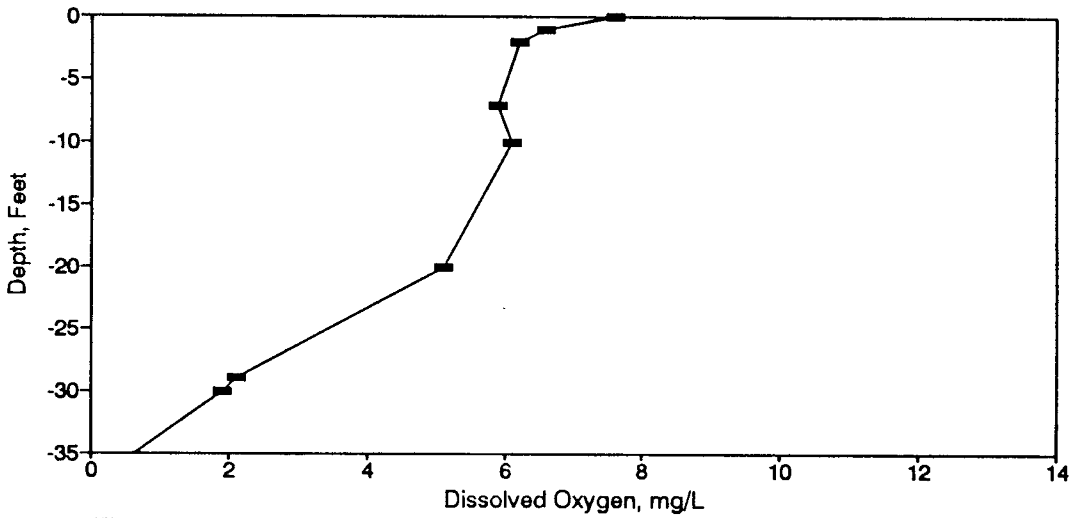

Figure BD91. Dissolved Oxygen Profile for the Waveland Site-June 15, 1988.

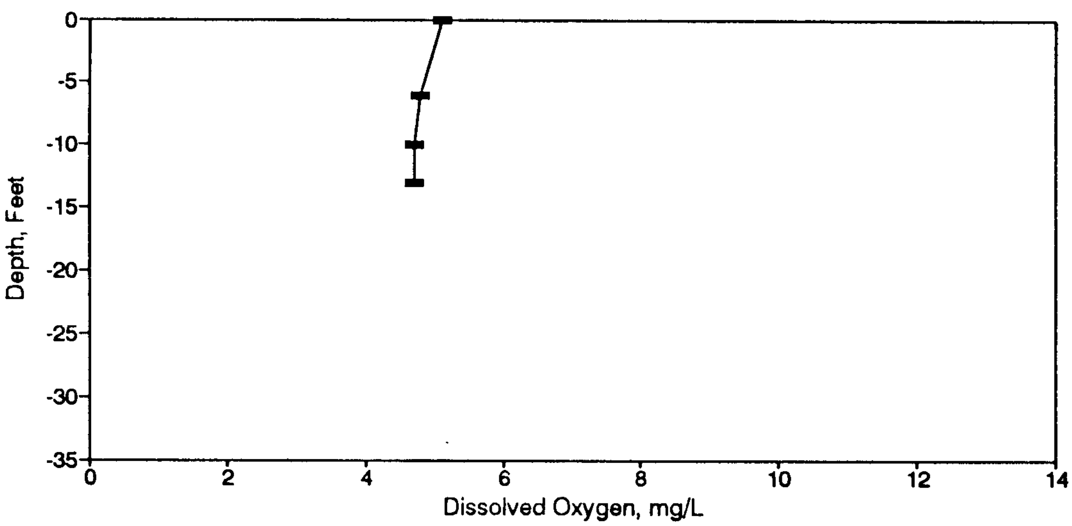

Figure BD92. Dissolved Oxygen Profile for the Waveland Site-July 6, 1988.

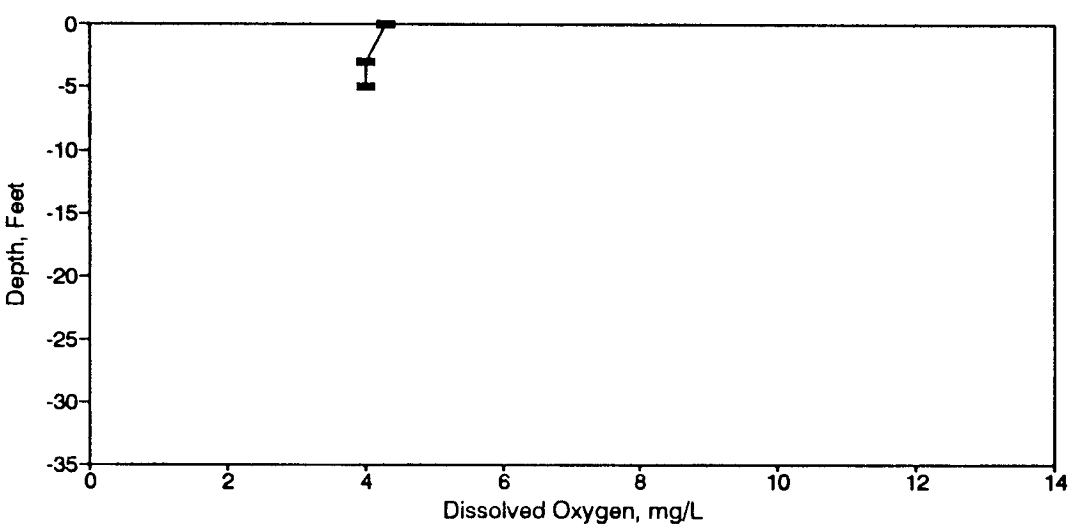

Figure BD93. Dissolved Oxygen Profile for the Waveland Site-August 11, 1988.

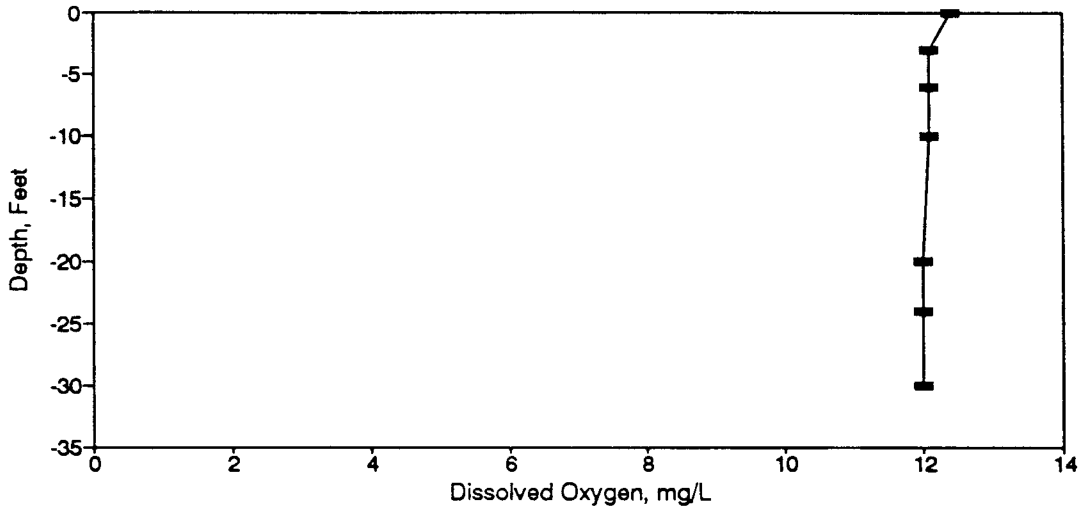

Figure BD94. Dissolved Oxygen Profile for the Waveland Site-January 12, 1989.

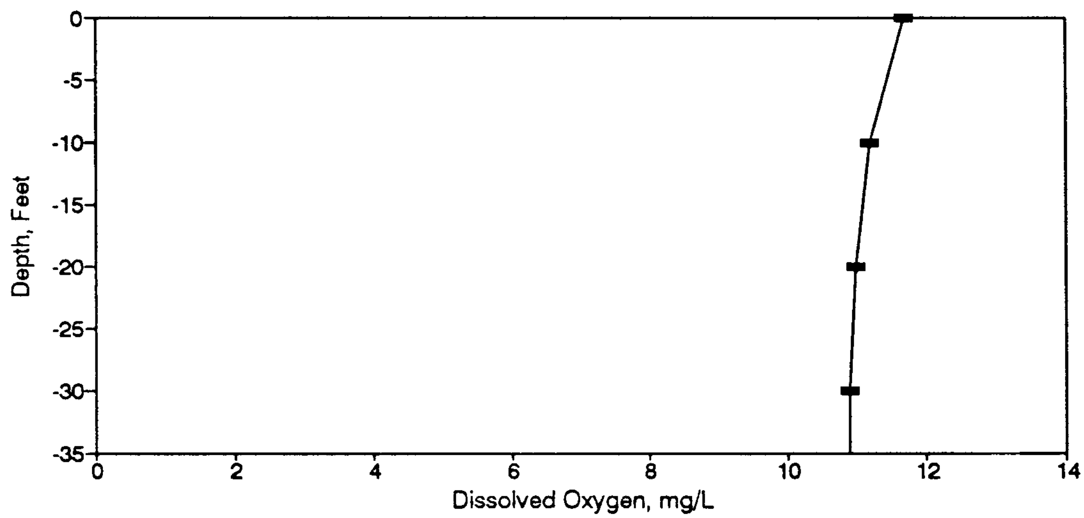

Figure BD95. Dissolved Oxygen Profile for the Waveland Site-February 1, 1989.

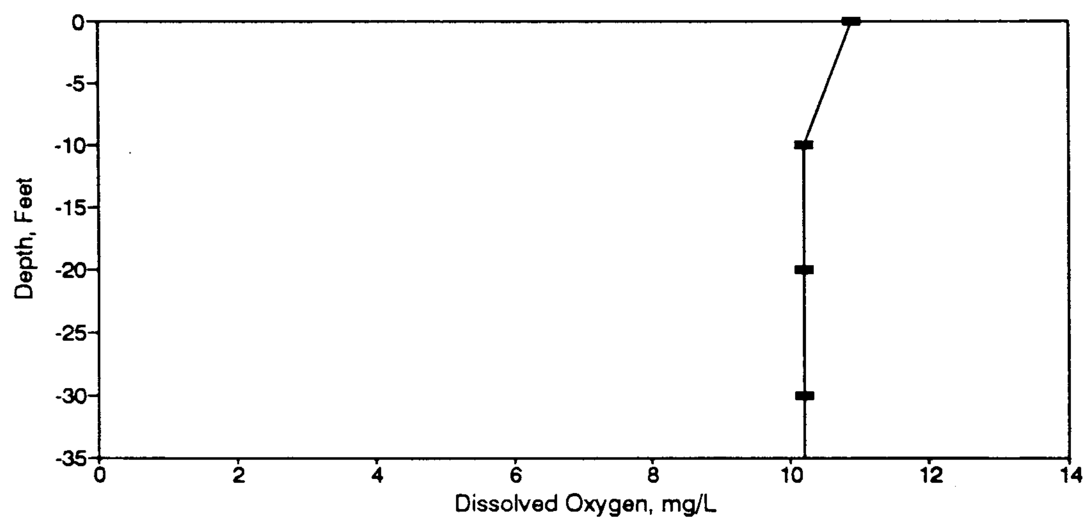

Figure BD96. Dissolved Oxygen Profile for the Waveland Site-March 20, 1989.

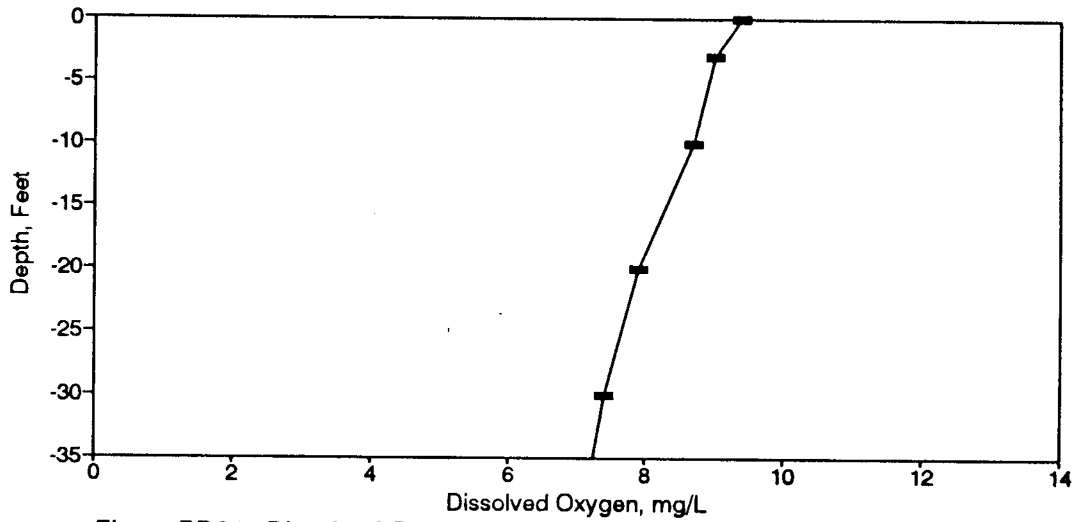

Figure BD97. Dissolved Oxygen Profile for the Waveland Site-April 17, 1989.

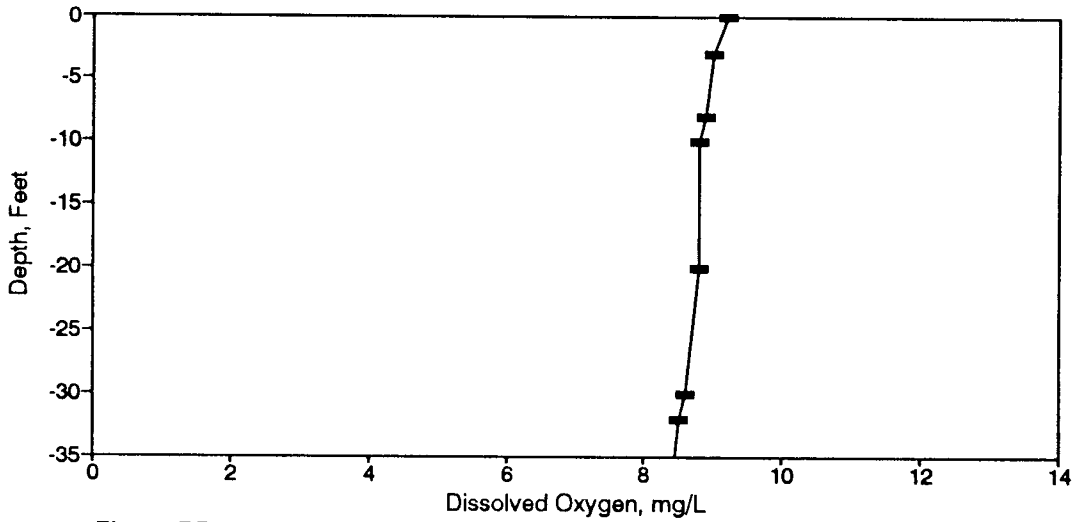

Figure BD98. Dissolved Oxygen Profile for the Waveland Site-May 11, 1989.

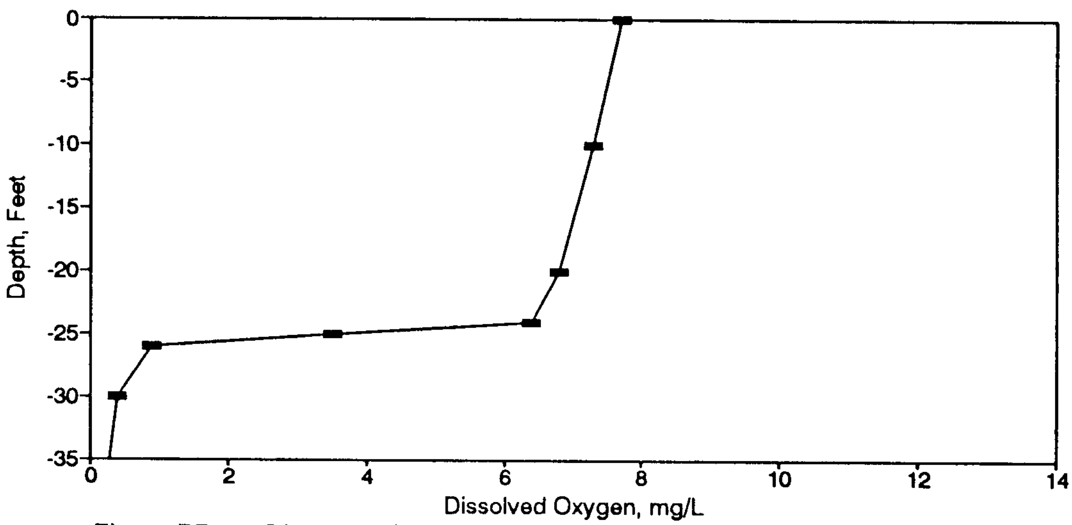

Figure BD99. Dissolved Oxygen Profile for the Waveland Site-June 19, 1989.

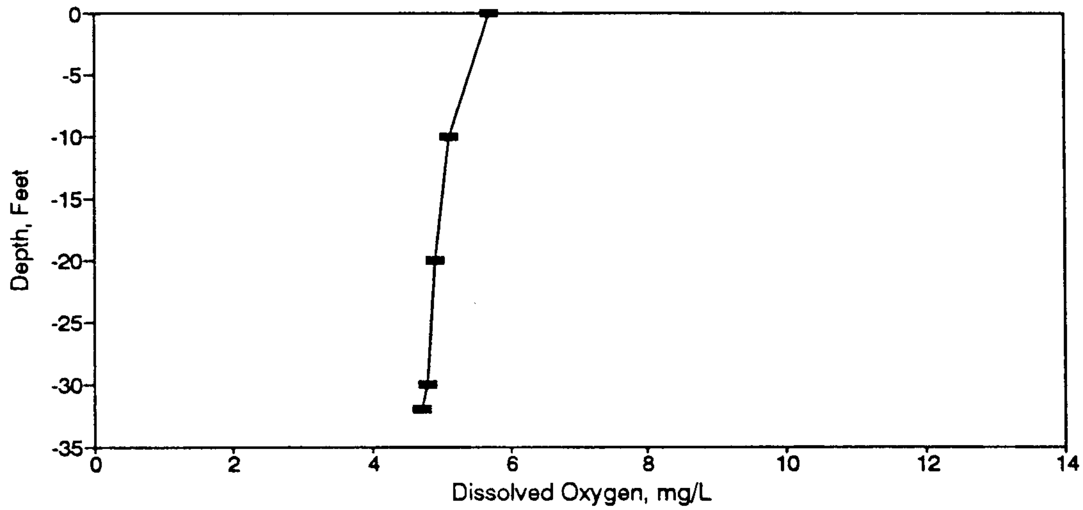

Figure BD100. Dissolved Oxygen Profile for the Waveland Site-July 17, 1989.

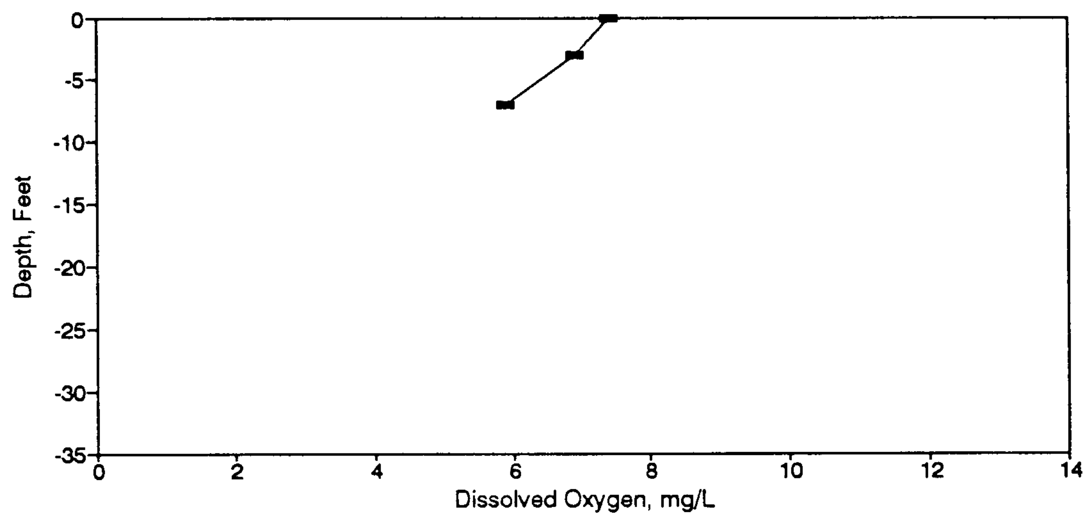

Figure BD101. Dissolved Oxygen Profile for the Waveland Site-August 7, 1989.

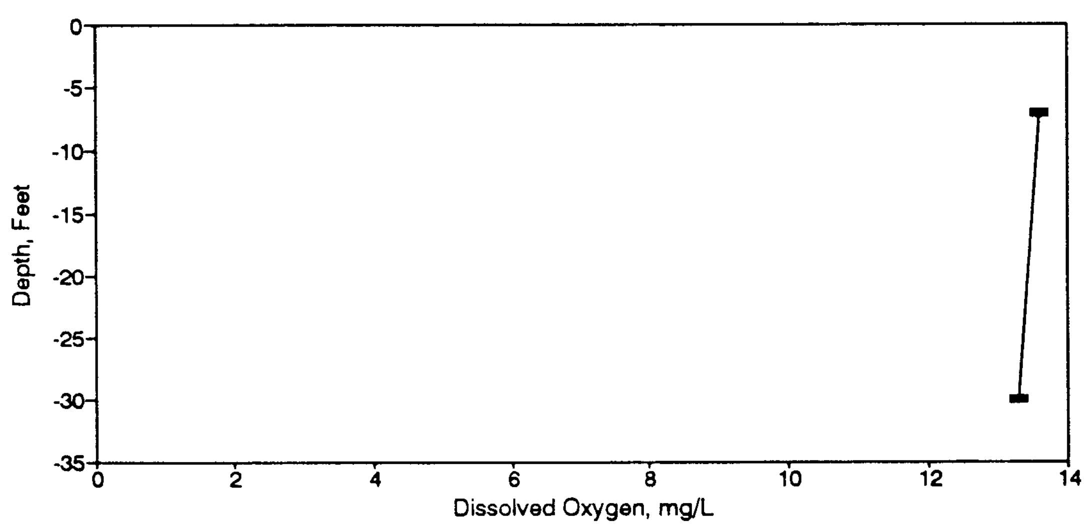

Figure BD102. Dissolved Oxygen Profile for the Waveland Site-December 13, 1989.

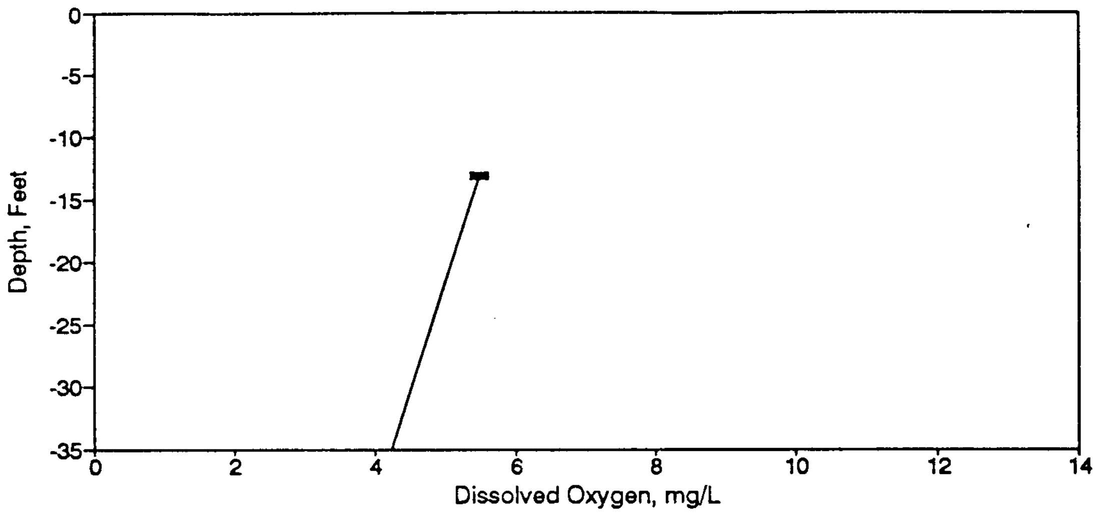

Figure BD103. Dissolved Oxygen Profile for the Waveland Site-May 24, 1990.

APPENDIX BT

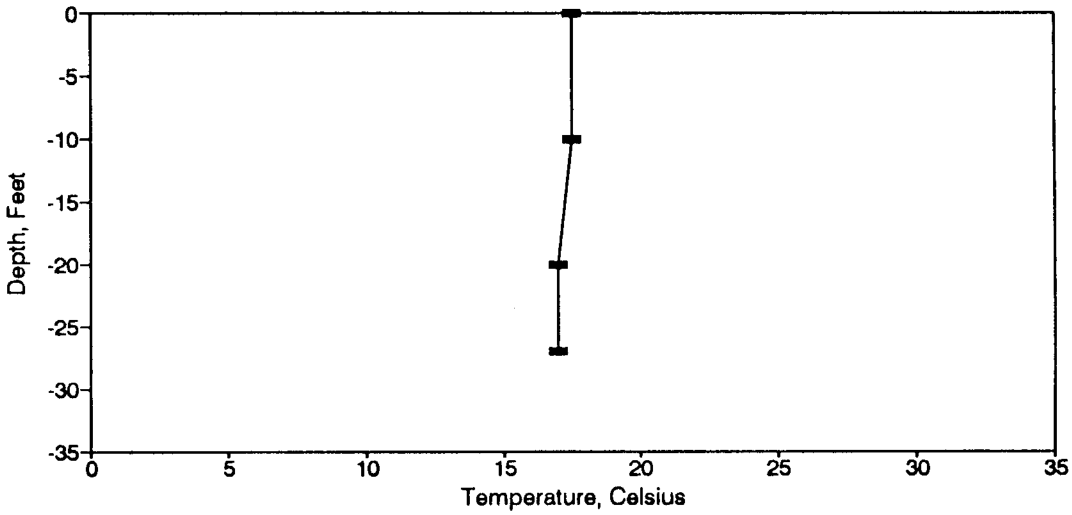

Figure BT1. Temperature Profile for the Waveland Site-October 15, 1980.

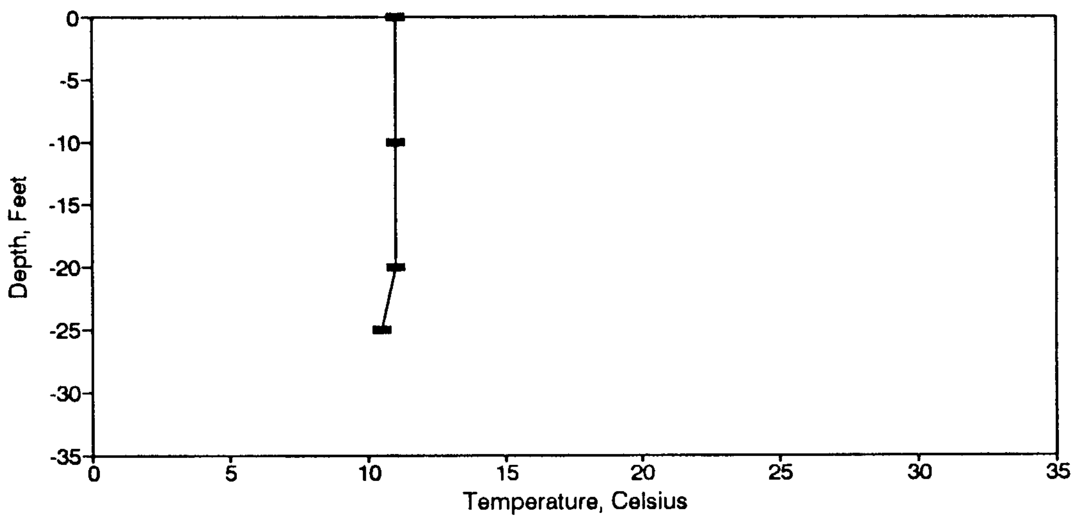

Figure BT2. Temperature Profile for the Waveland Site-November 18, 1980

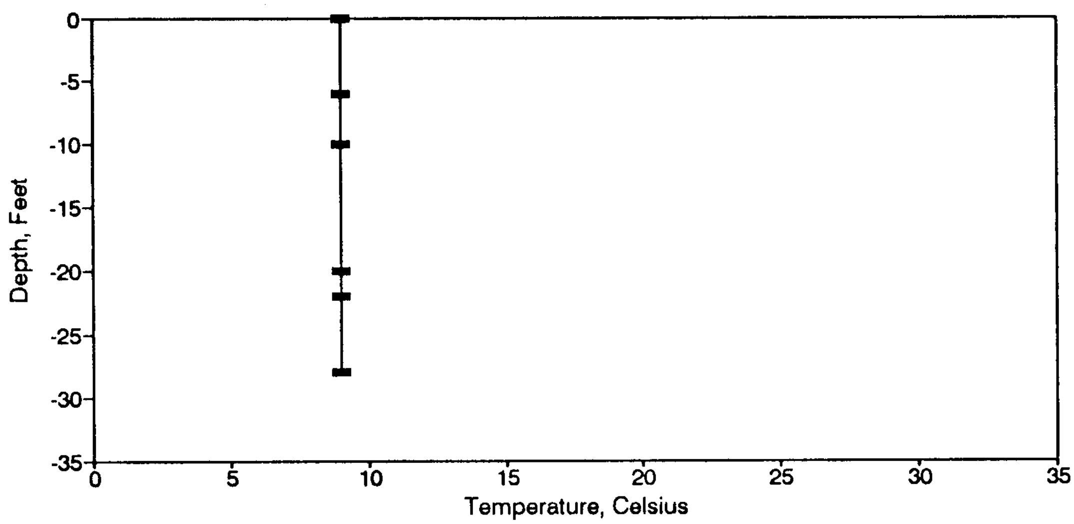

Figure BT3. Temperature Profile for the Waveland Site-December 9, 1980.

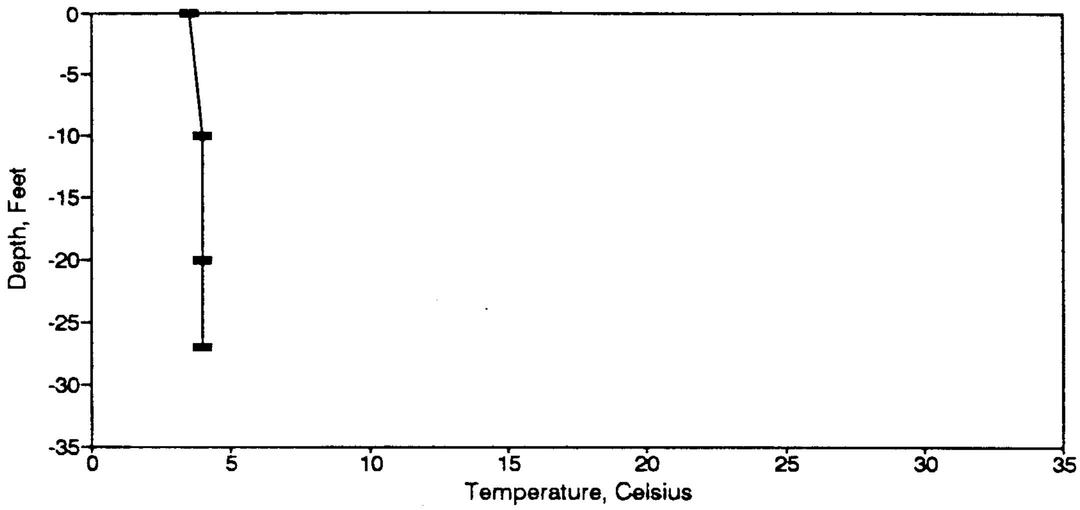

Figure BT4. Temperature Profile for the Waveland Site-February 2, 1981.

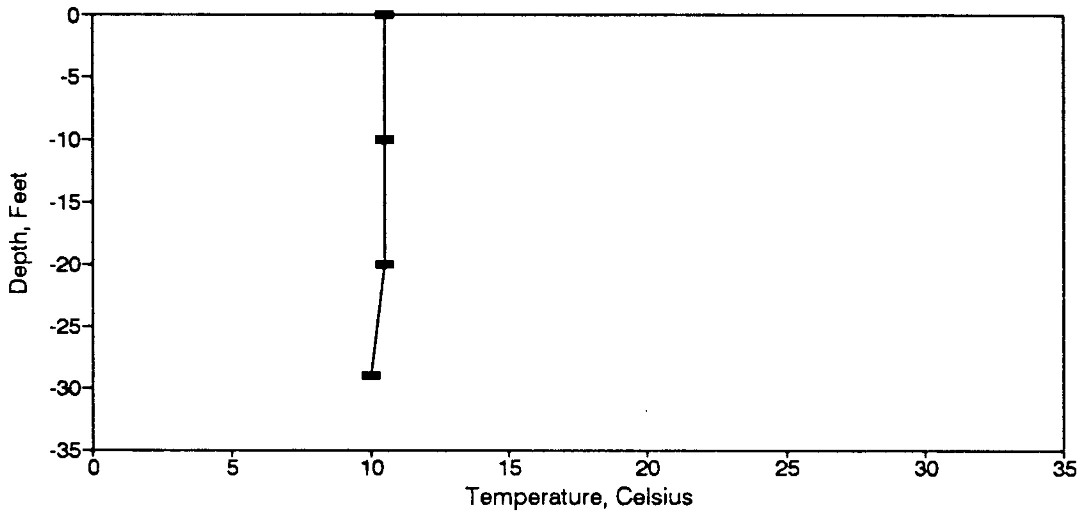

Figure BT5. Temperature Profile for the Waveland Site-March 3, 1981.

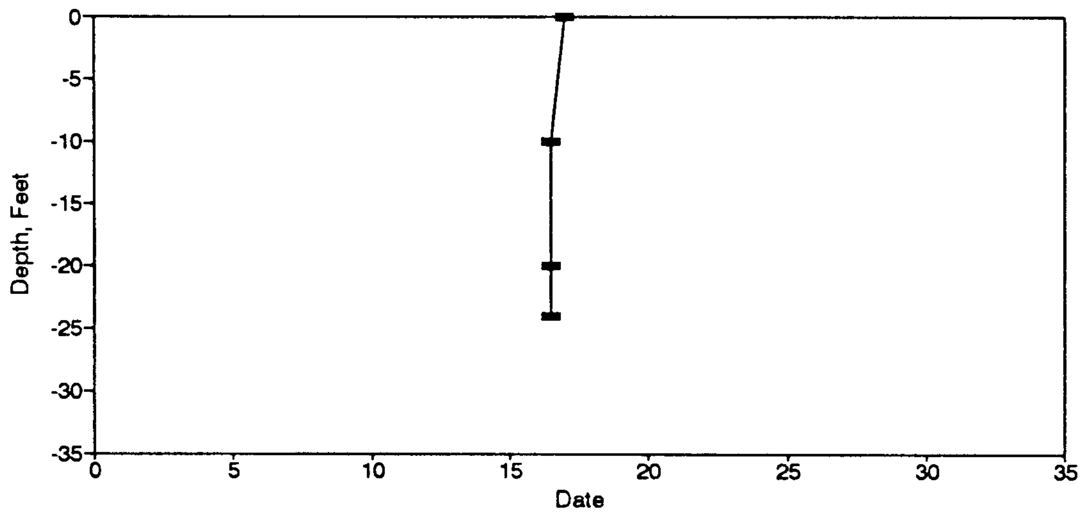

Figure BT6. Temperature Profile for the Waveland Site-April 7, 1981.

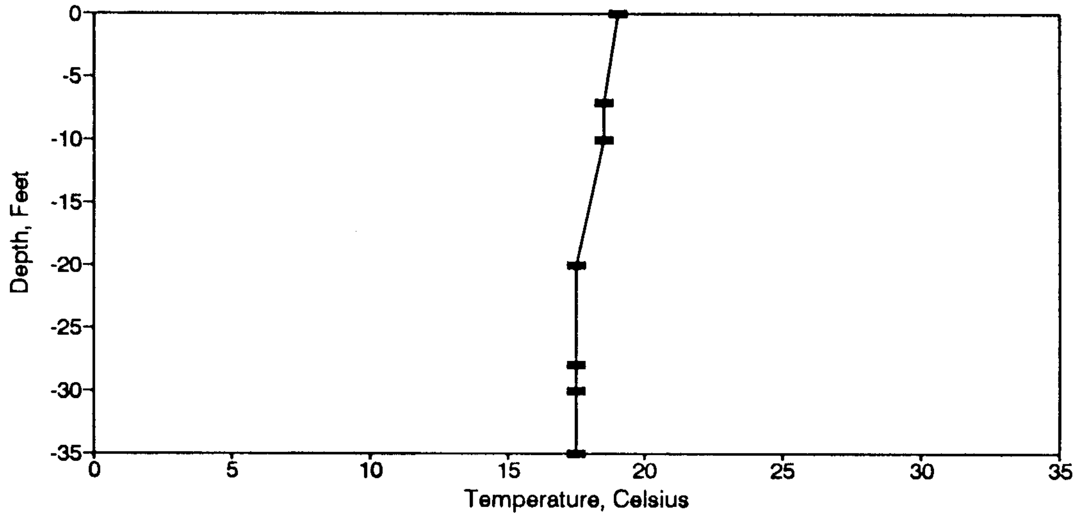

Figure BT7. Temperature Profile for the Waveland Site-May 12, 1981.

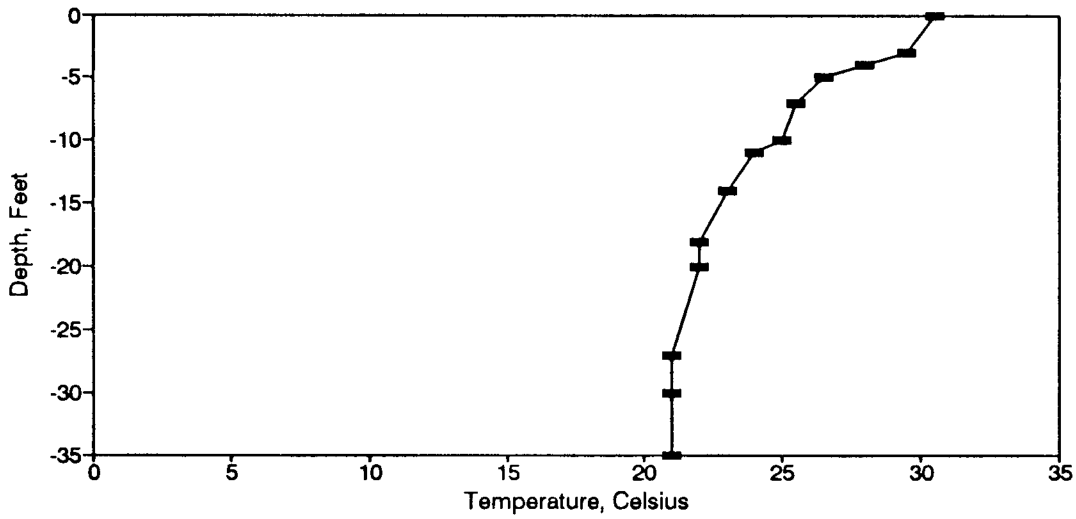

Figure BT8. Temperature Profile for the Waveland Site-June 9, 1981.

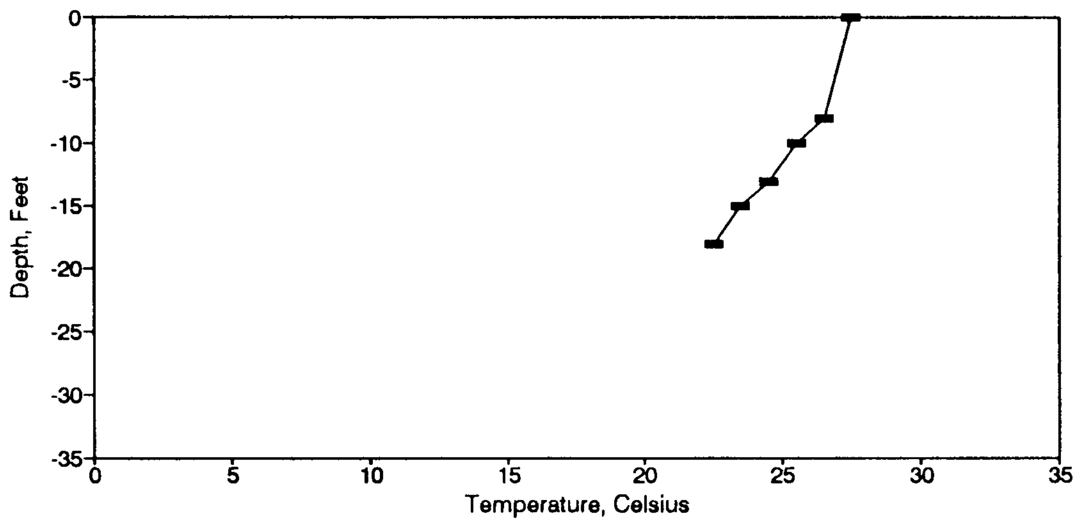

Figure BT9. Temperature Profile for the Waveland Site-July 7, 1981.

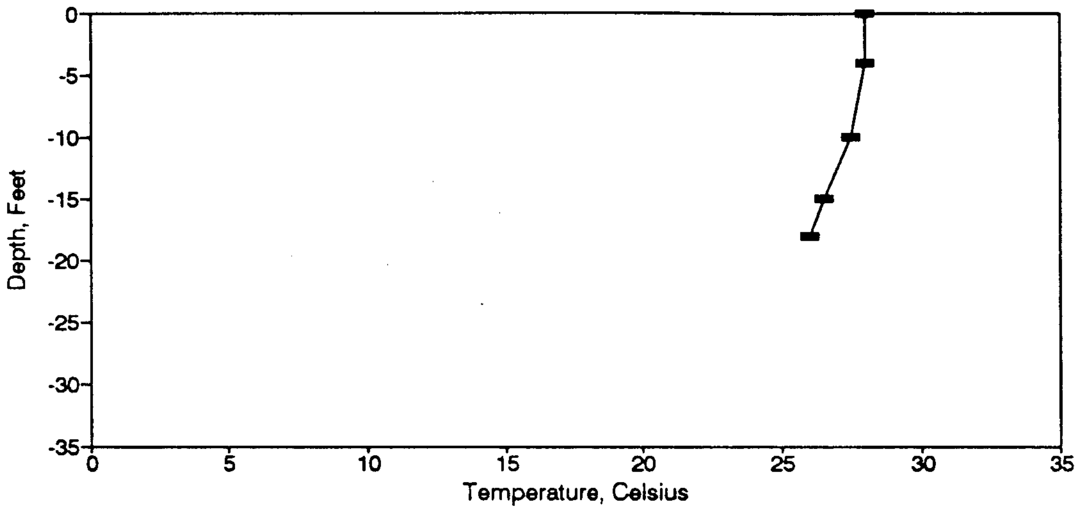

Figure BT10. Temperature Profile for the Waveland Site-August 11, 1981.

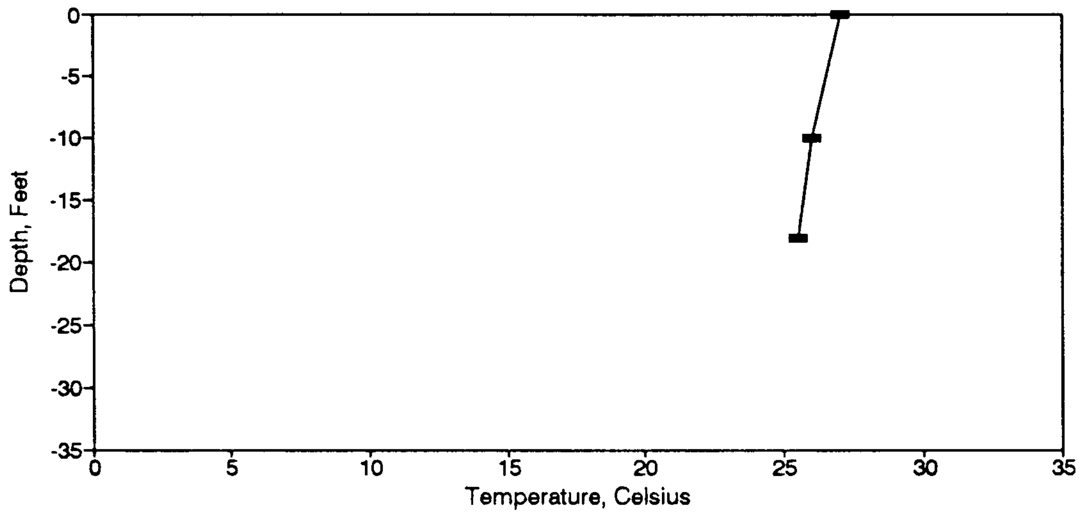

Figure BT11. Temperature Profile for the Waveland Site-September 9, 1981.

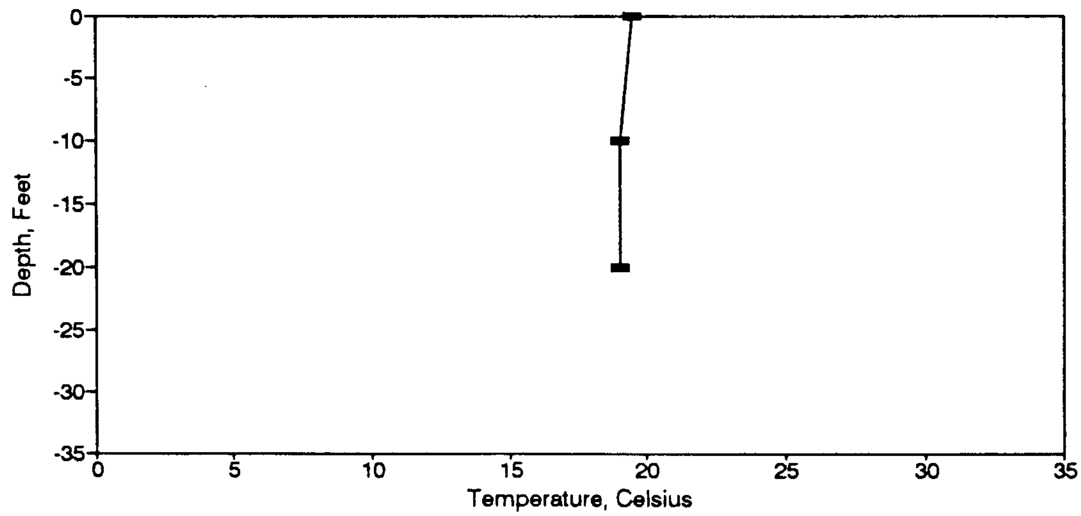

Figure BT12. Temperature Profile for the Waveland Site-October 13, 1981.

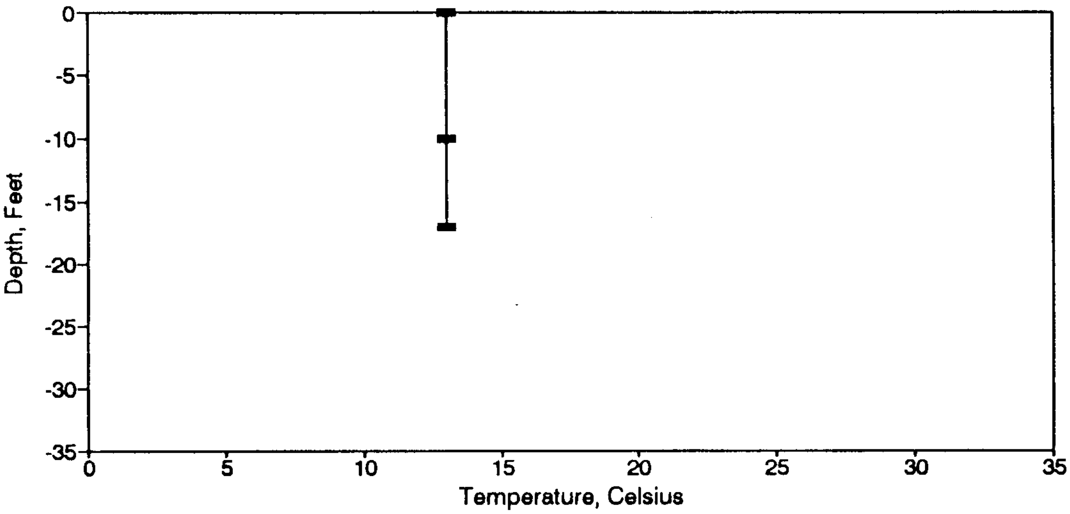

Figure BT13. Temperature Profile for the Waveland Site-November 19,1981.

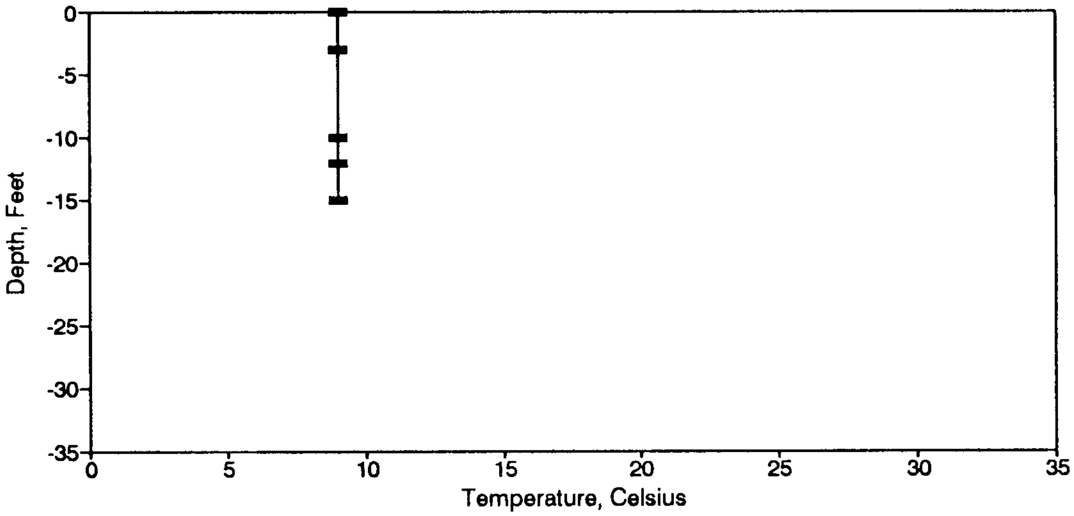

Figure BT14. Temperature Profile for the Waveland Site-December 8, 1981.

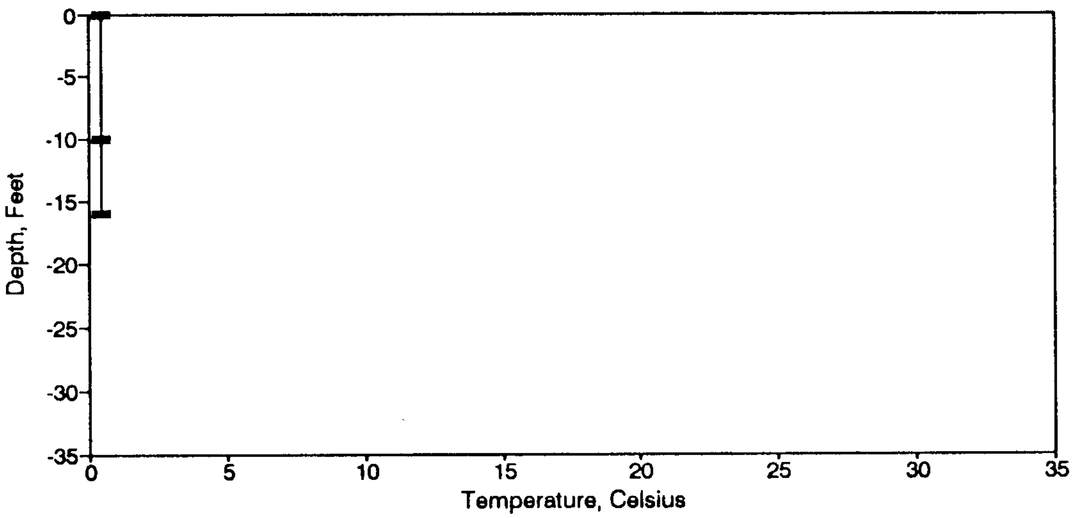

Figure BT15. Temperature Profile for the Waveland Site-January 15, 1982.

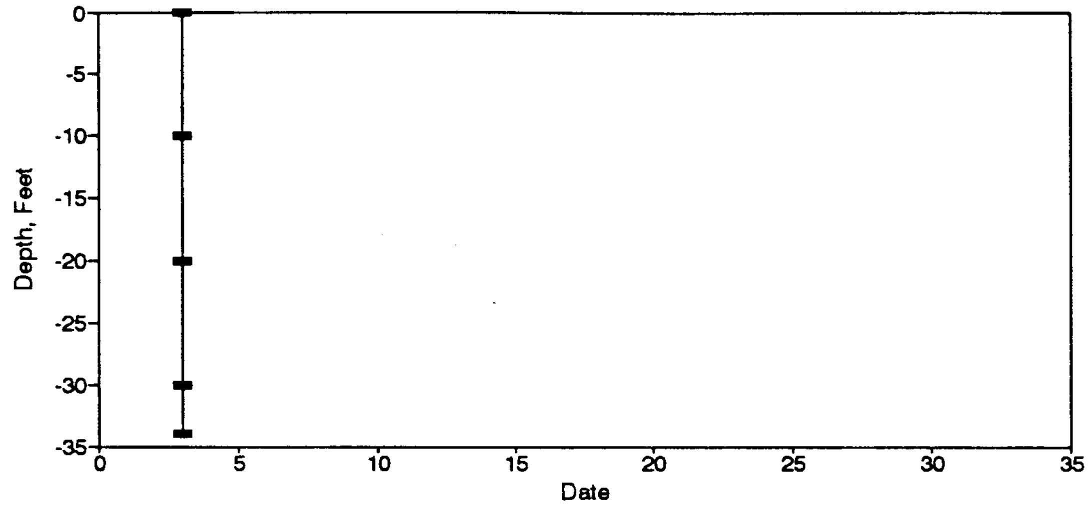

Figure BT16. Temperature Profile for the Waveland Site-February 12, 1982.

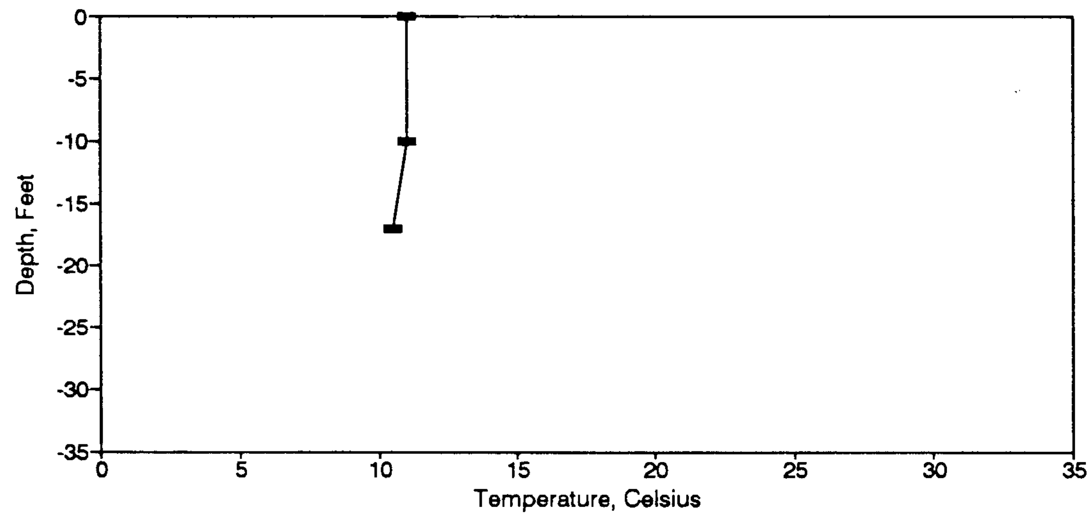

Figure BT17. Temperature Profile for the Waveland Site-March 15, 1982.

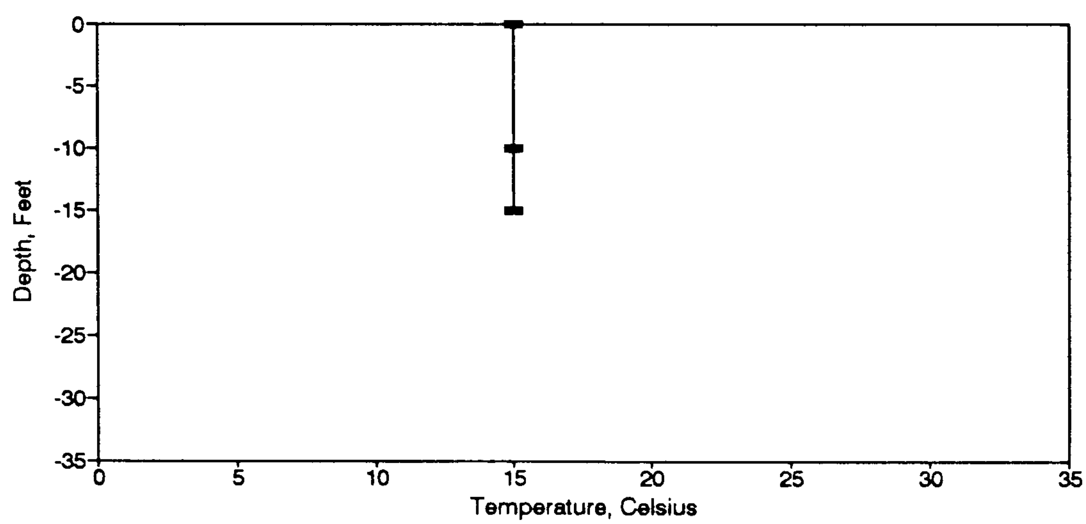

Figure BT18. Temperature Profile for the Waveland Site-April 2, 1982.

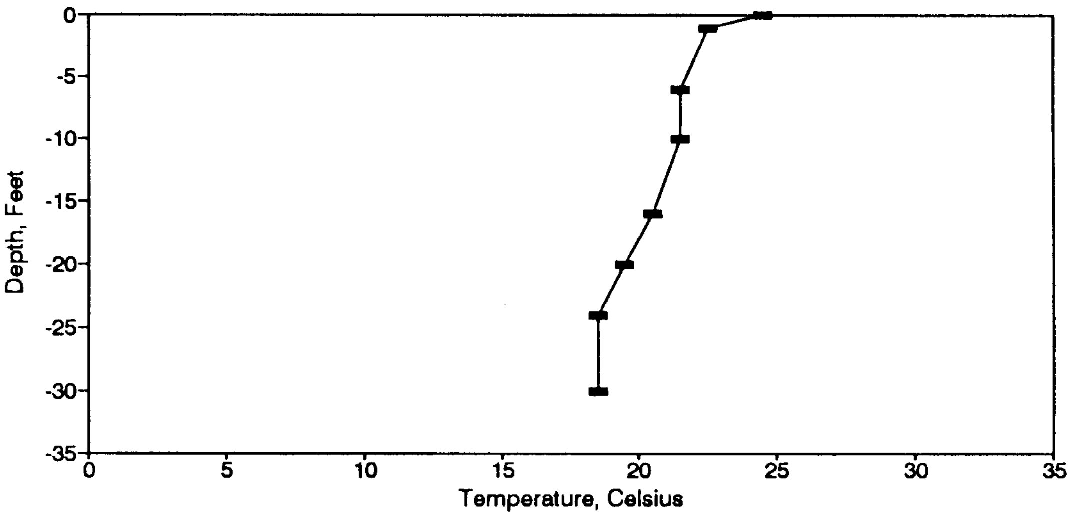

Figure BT19. Temperature Profile for the Waveland Site-May 17, 1982.

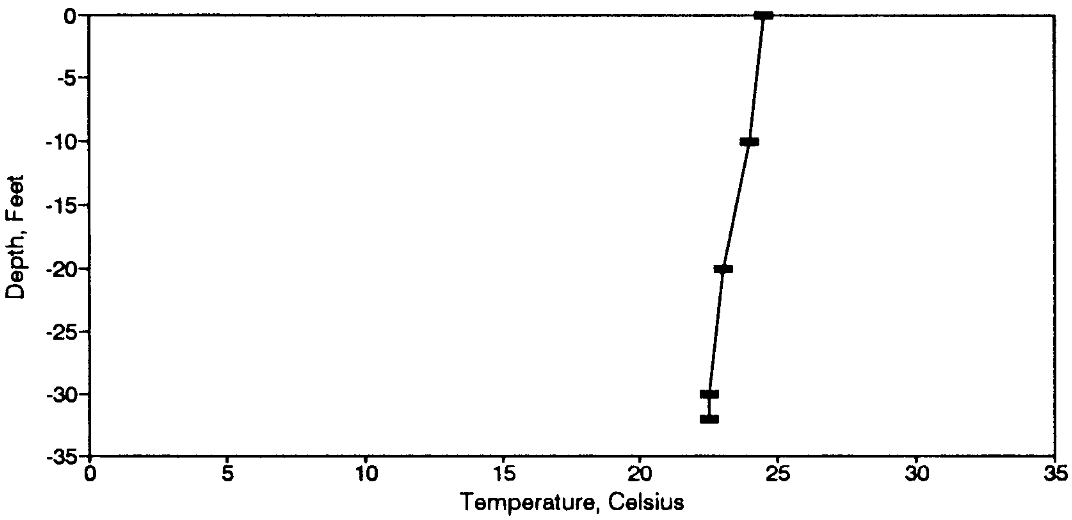

Figure BT20. Temperature Profile for the Waveland Site-June 18, 1982.

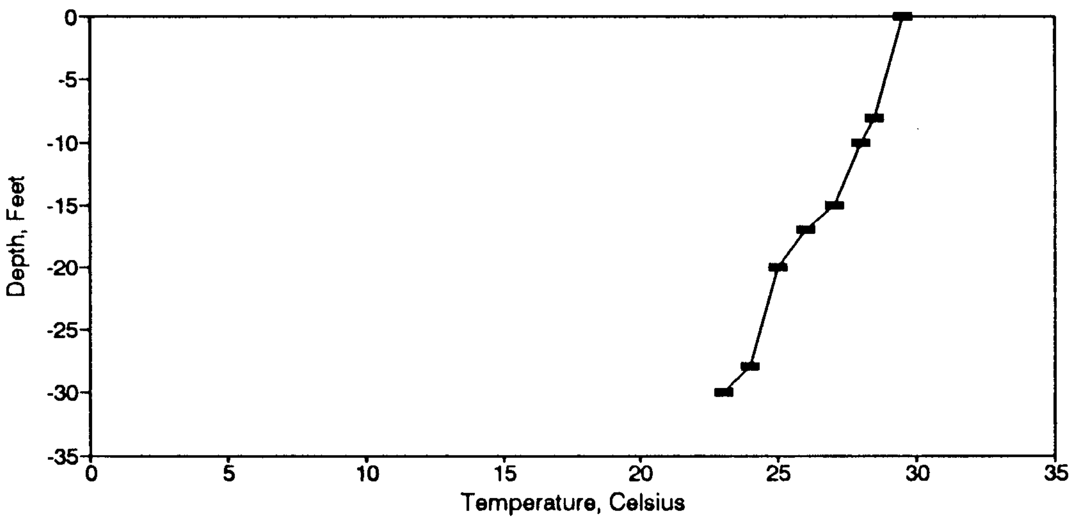

Figure BT21. Temperature Profile for the Waveland Site-July 12, 1982.

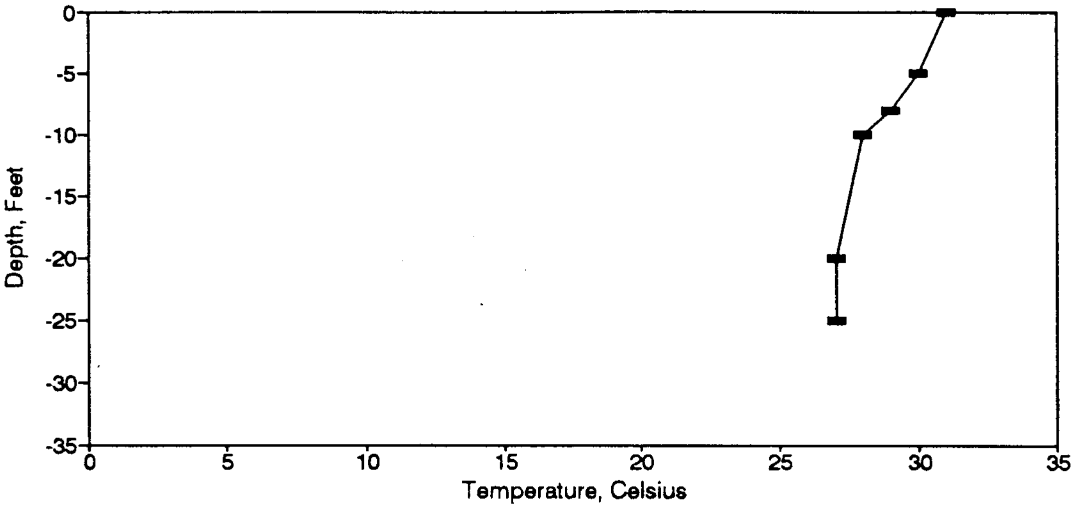

Figure BT22. Temperature Profile for the Waveland Site-August 16, 1982.

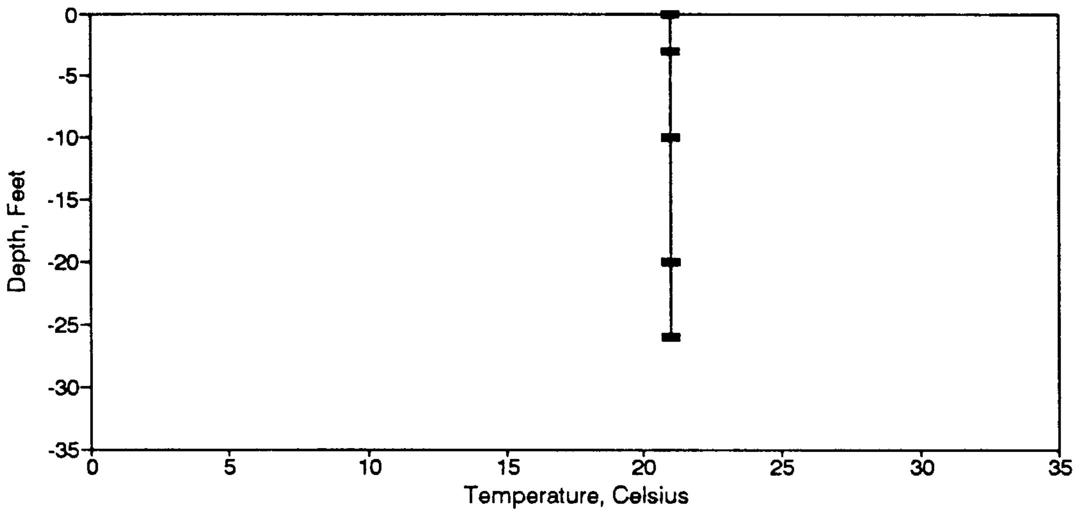

Figure BT23. Temperature Profile for the Waveland Site-September 29, 1982.

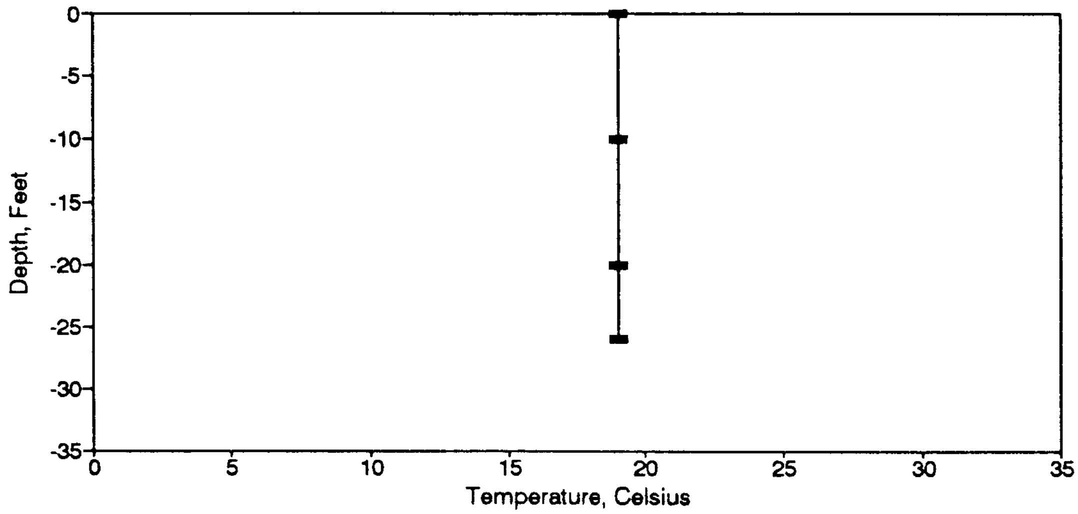

Figure BT24. Temperature Profile for the Waveland Site-October 15, 1982.

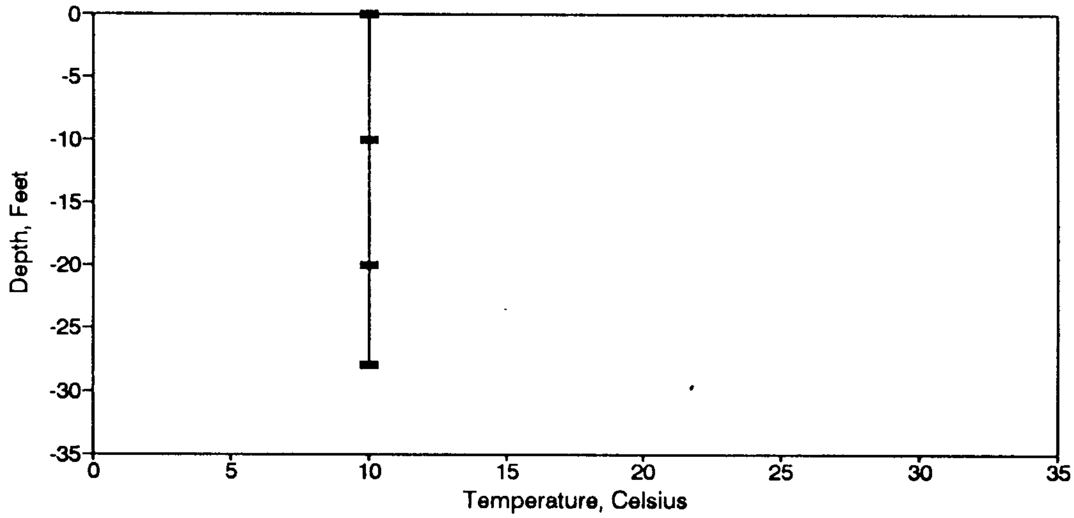

Figure BT25. Temperature Profile for the Waveland Site-November 16, 1982.

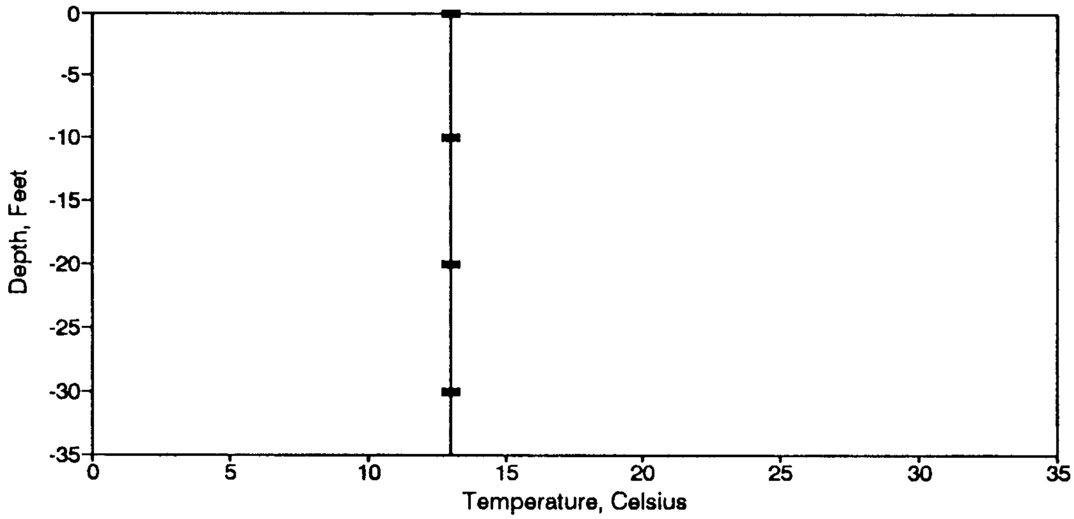

Figure BT26. Temperature Profile for the Waveland Site-December 20, 1982.

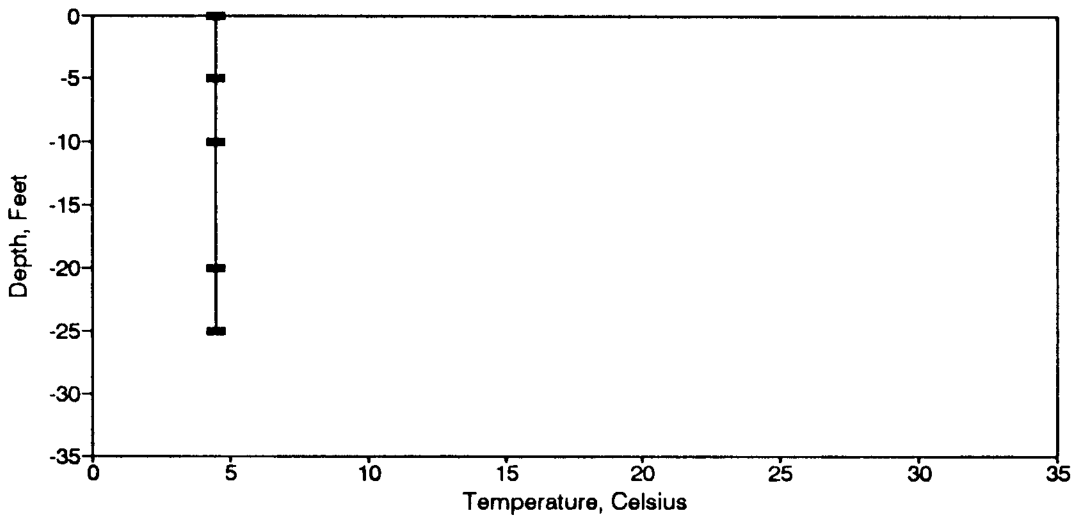

Figure BT27. Temperature Profile for the Waveland Site-January 26, 1983.

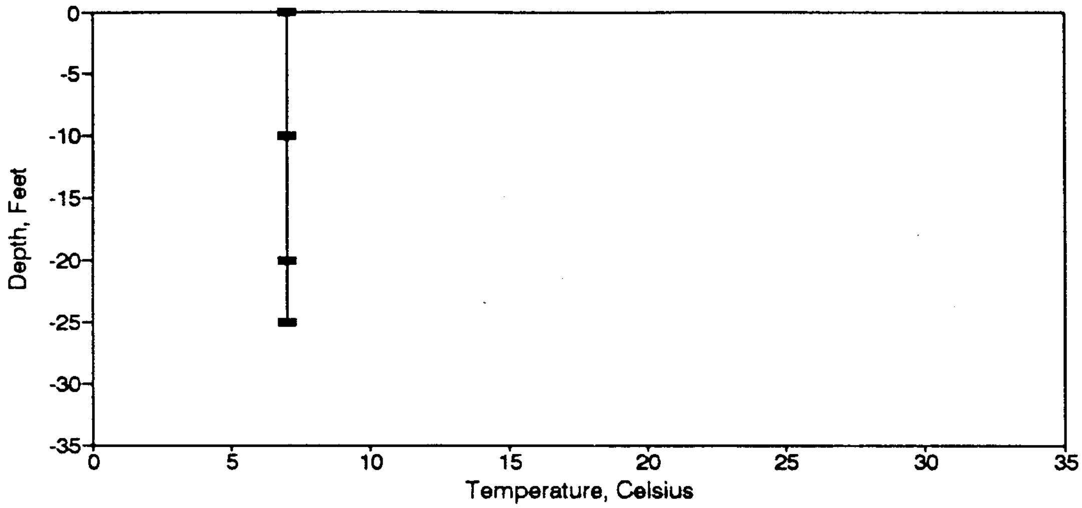

Figure BT28. Temperature Profile for the Waveland Site-February 18, 1983.

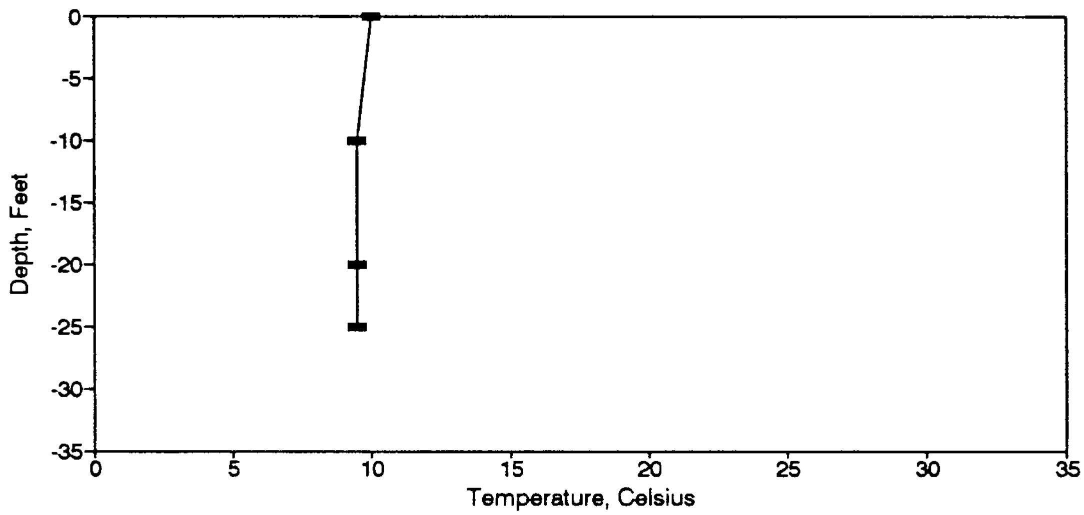

Figure BT29. Temperature Profile for the Waveland Site-March 25, 1983.

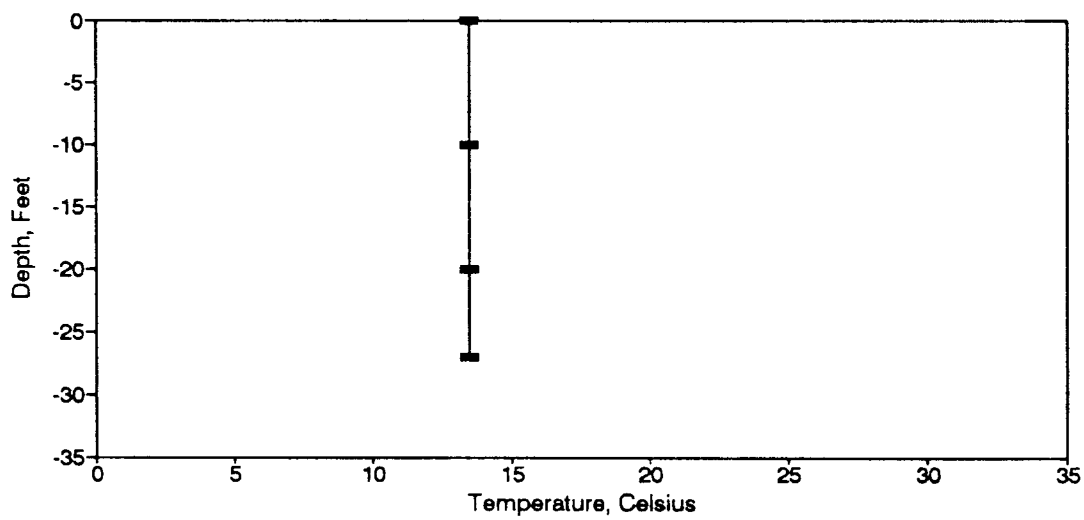

Figure BT30. Temperature Profile for the Waveland Site-April 18, 1983.

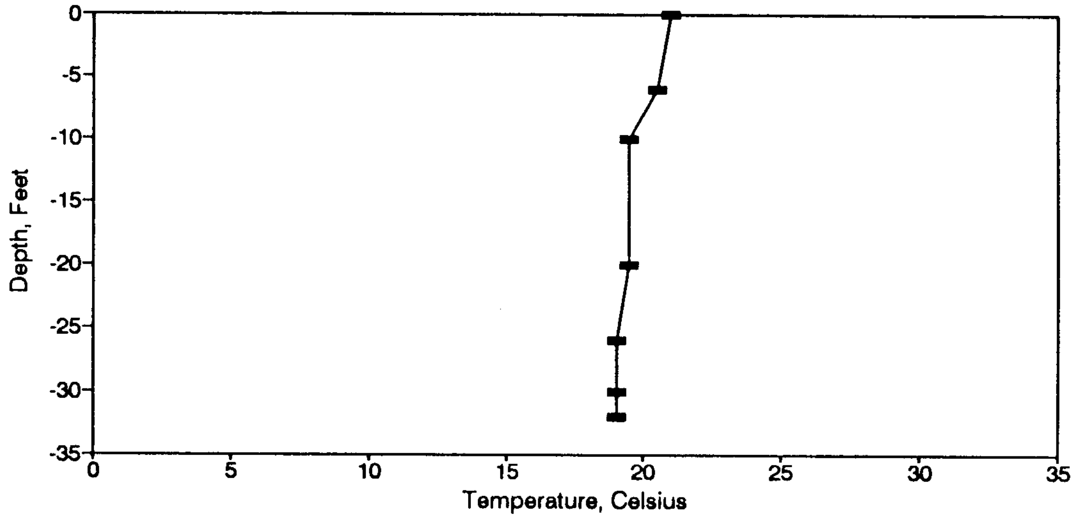

Figure BT31. Temperature Profile for the Waveland Site-May 16, 1983.

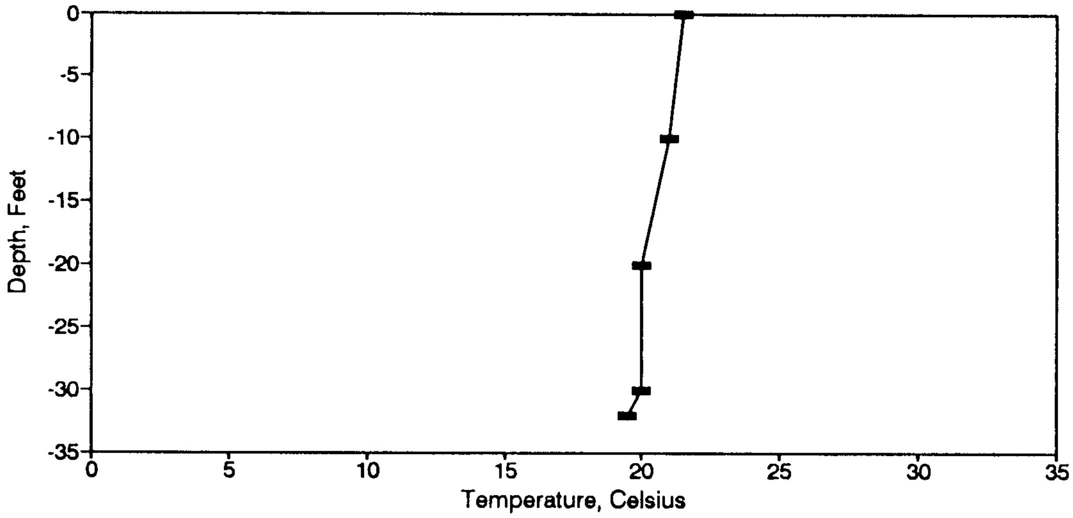

Figure BT32. Temperature Profile for the Waveland Site-June 9, 1983.

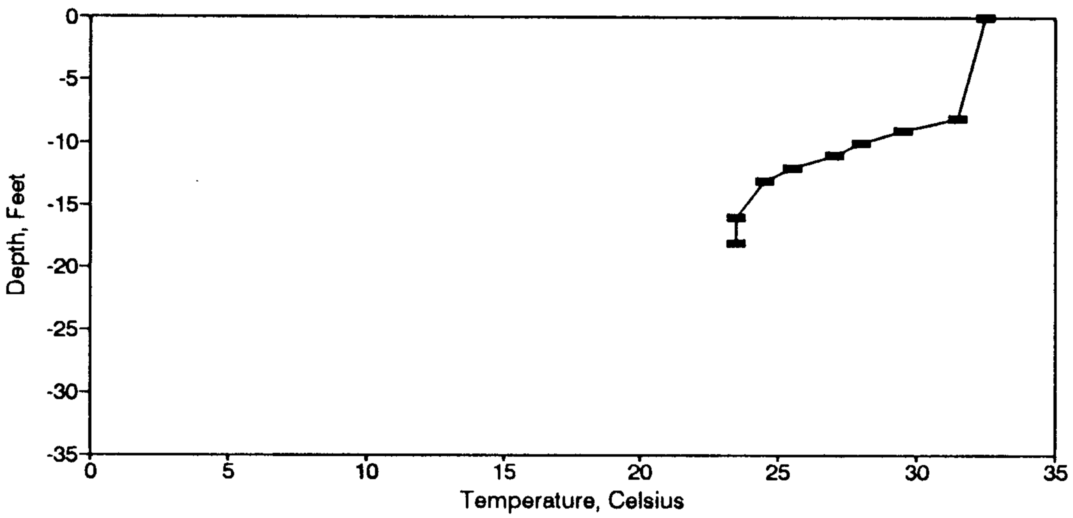

Figure BT33. Temperature Profile for the Waveland Site-July 22, 1983.

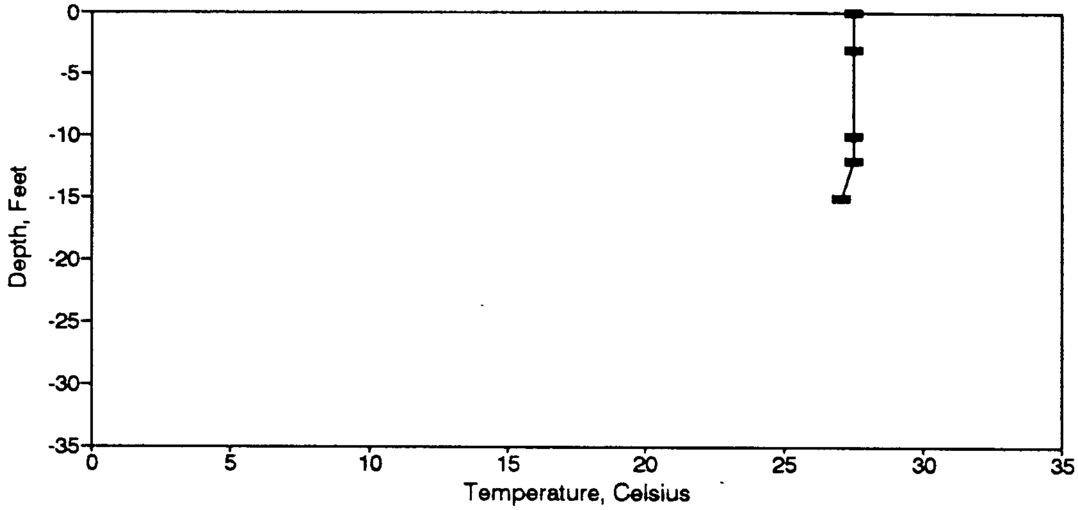

Figure BT34. Temperature Profile for the Waveland Site-August 15, 1983.

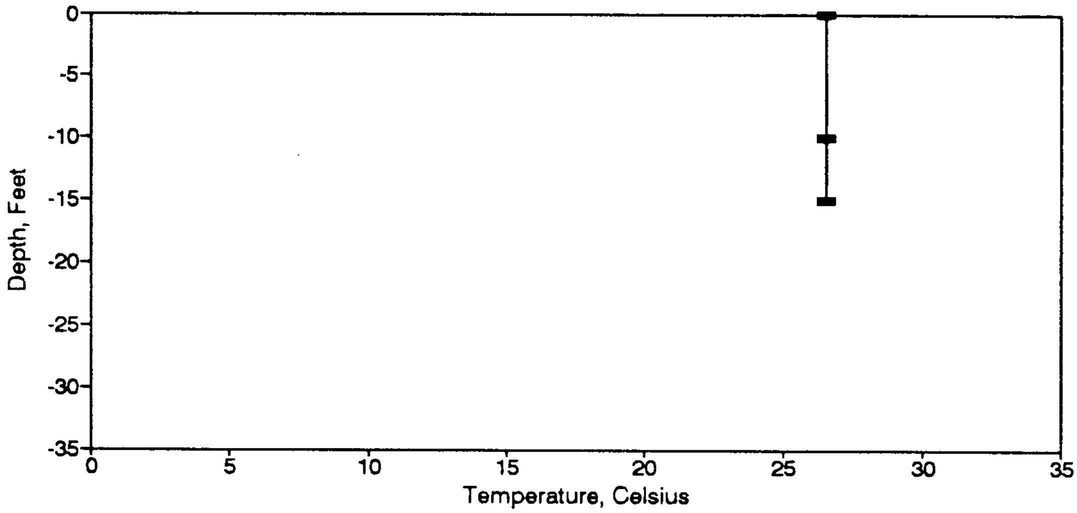

Figure BT35. Temperature Profile for the Waveland Site-September 14, 1983.

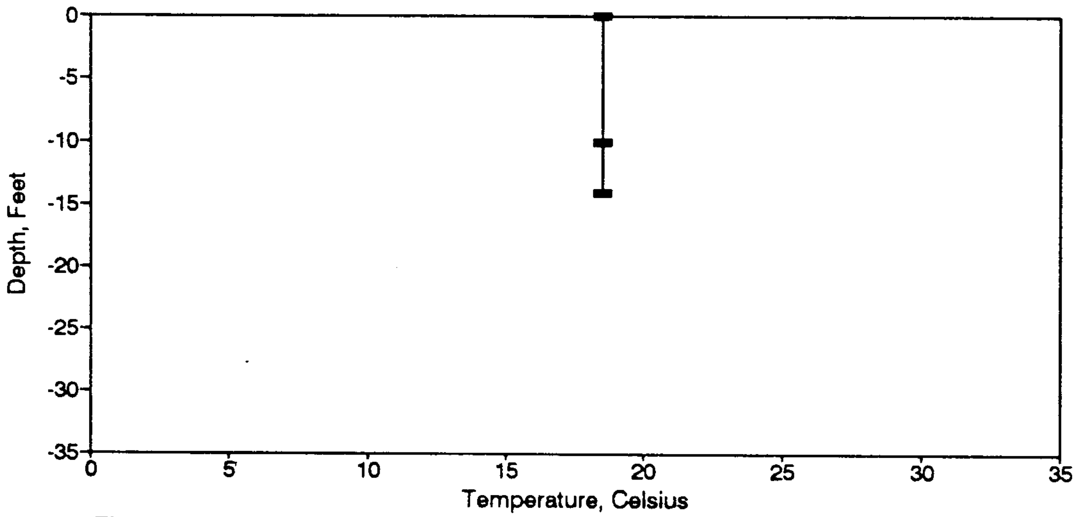

Figure BT36. Temperature Profile for the Waveland Site-October 14, 1983.

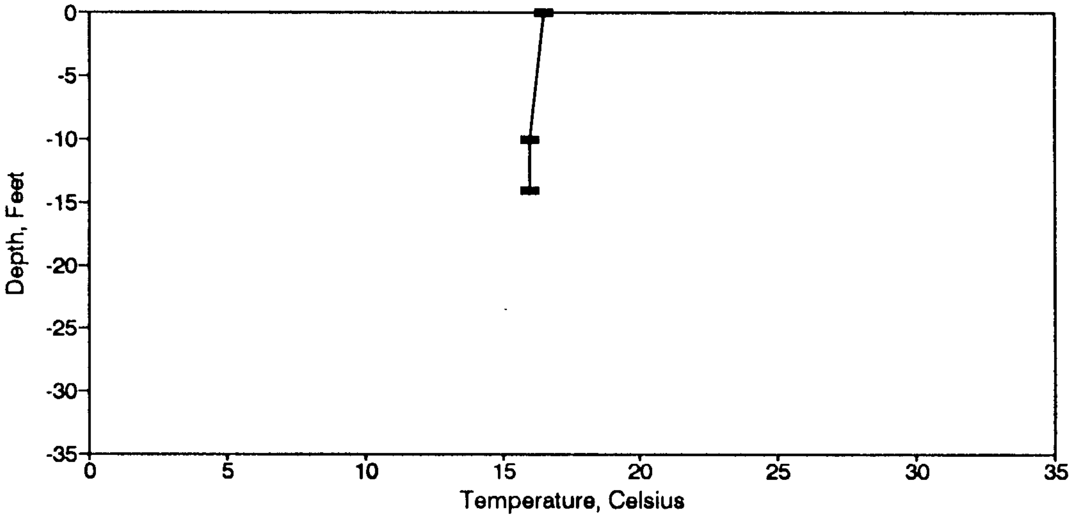

Figure BT37. Temperature Profile for the Waveland Site-November 1, 1983.

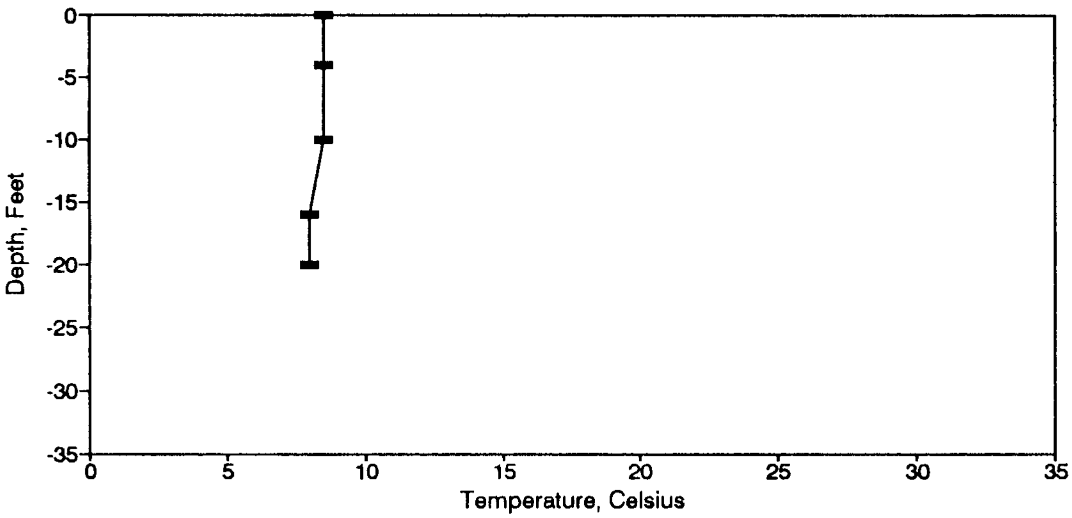

Figure BT38. Temperature Profile for the Waveland Site-December 5, 1983.

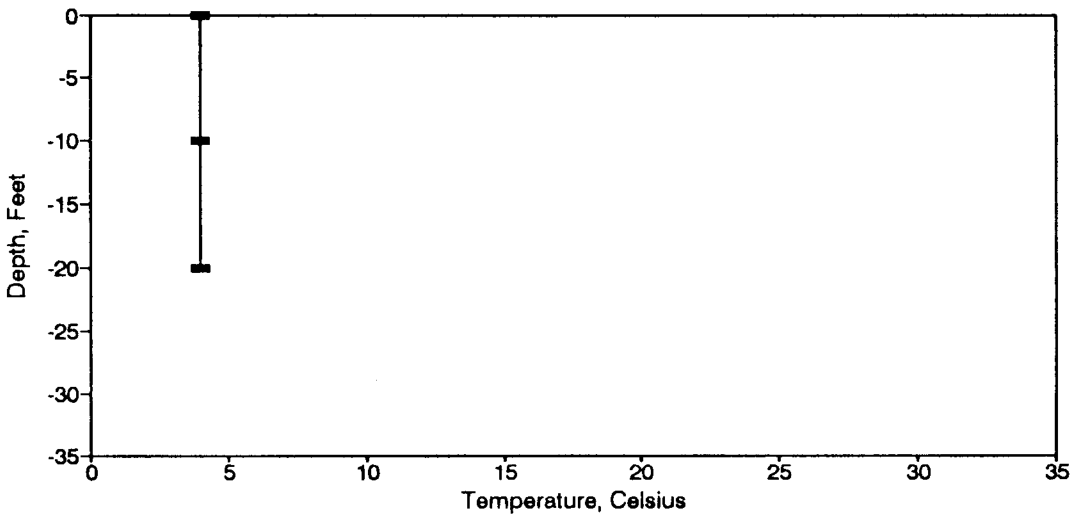

Figure BT39. Temperature Profile for the Waveland Site-January 12, 1984.

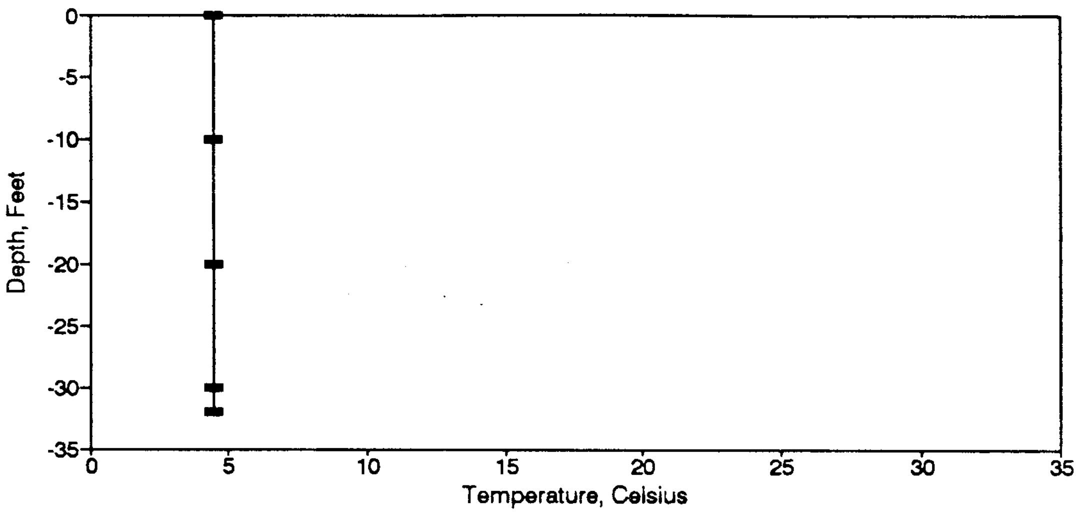

Figure BT40. Temperature Profile for the Waveland Site-February 6, 1984.

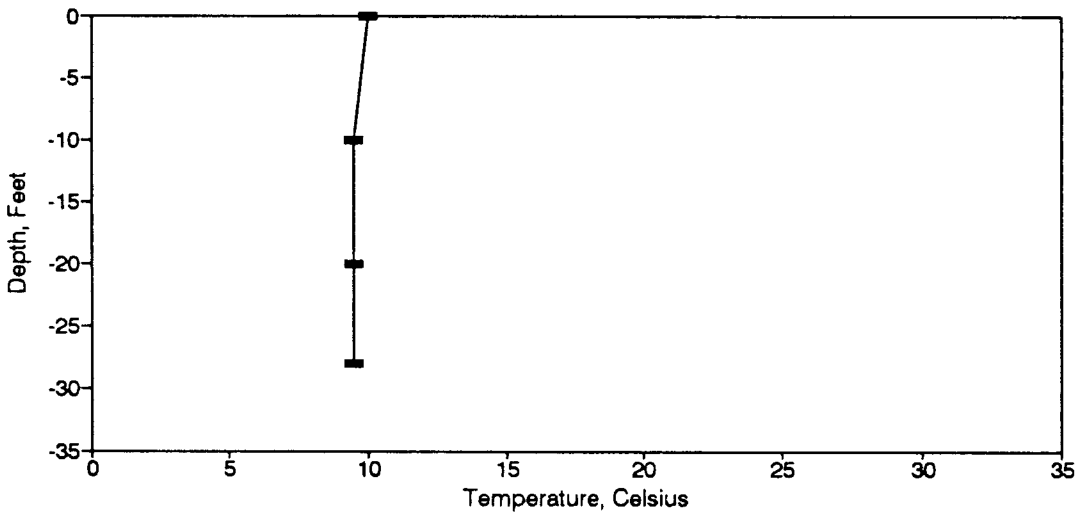

Figure BT41. Temperature Profile for the Waveland Site-March 19, 1984.

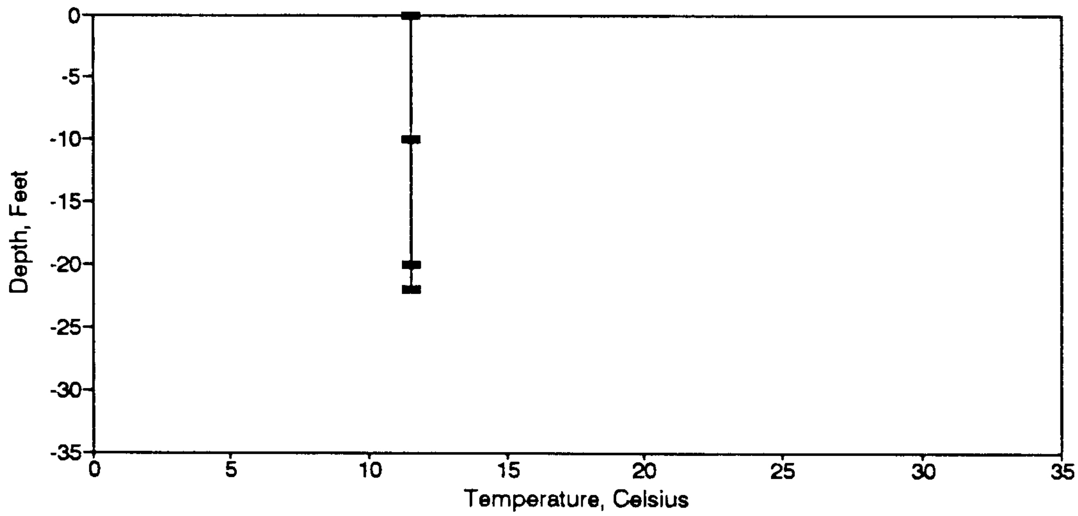

Figure BT42. Temperature Profile for the Waveland Site-April 9, 1984.

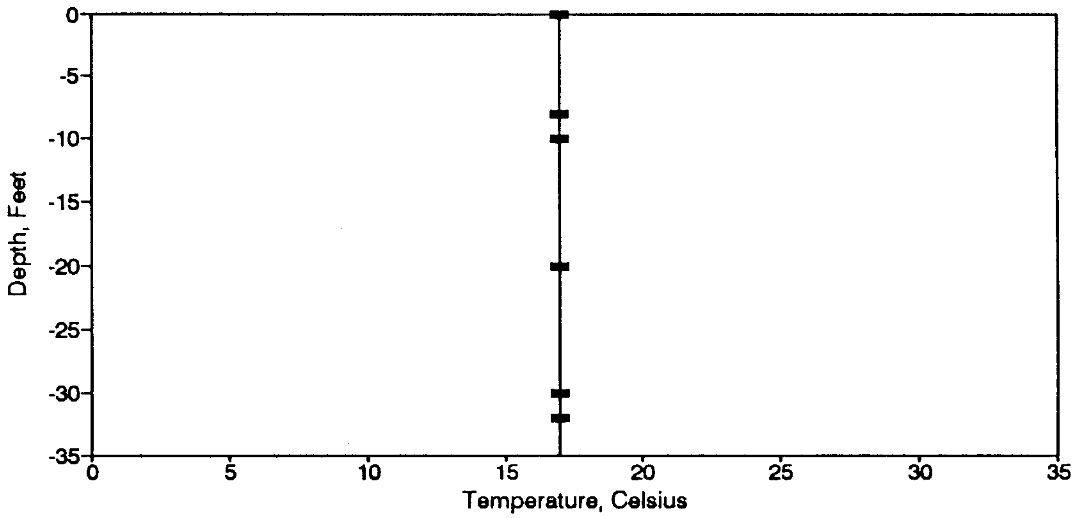

Figure BT43. Temperature Profile for the Waveland Site-May 8, 1984.

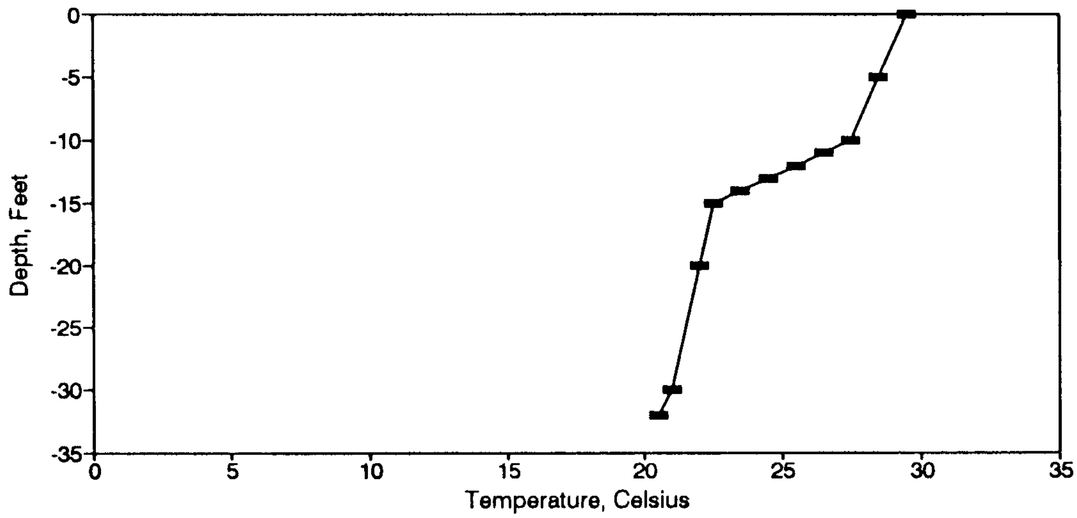

Figure BT44. Temperature Profile for the Waveland Site-June 18, 1984.

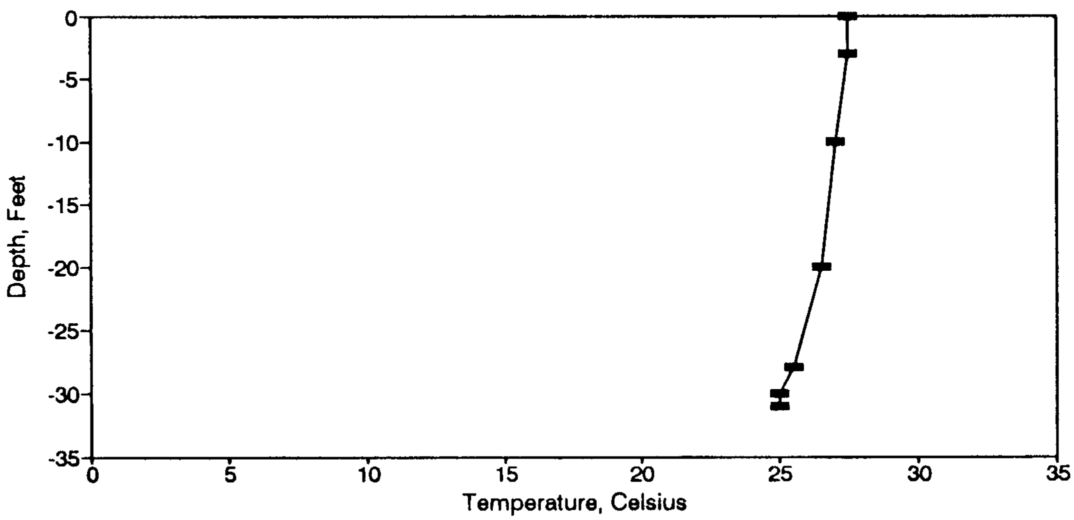

Figure BT45. Temperature Profile for the Waveland Site-July 23, 1984.

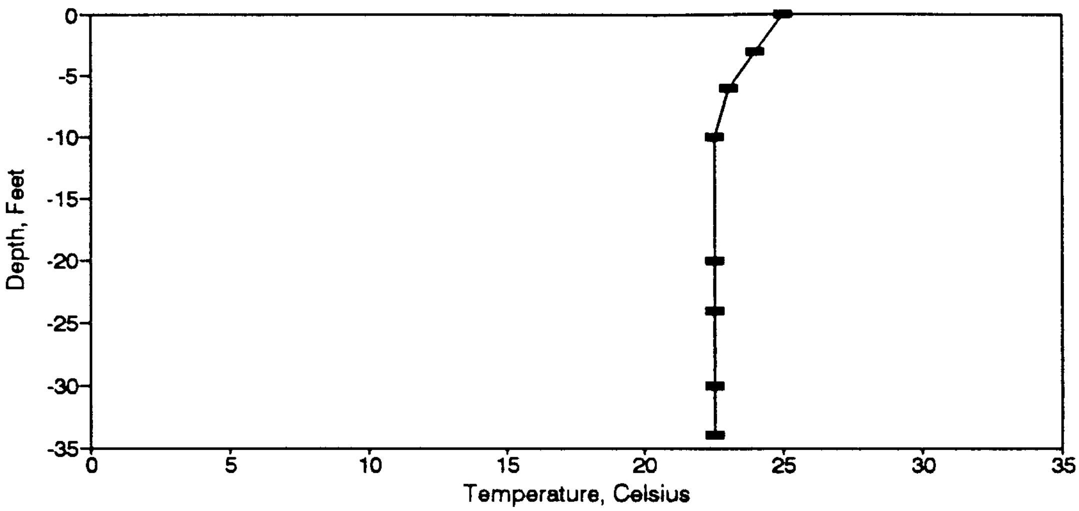

Figure BT46. Temperature Profile for the Waveland Site-August 27, 1984.

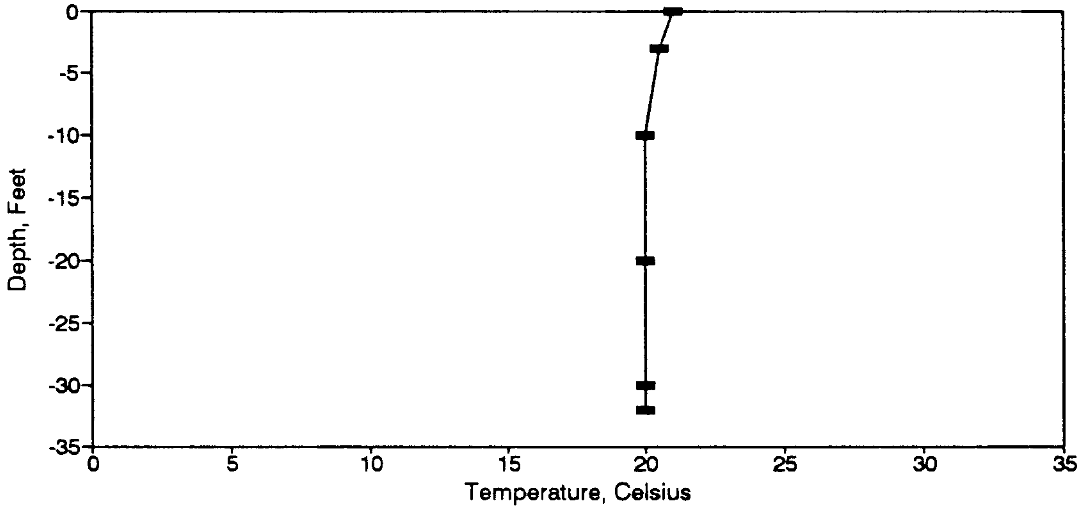

Figure BT47. Temperature Profile for the Waveland Site-September 24, 1984.

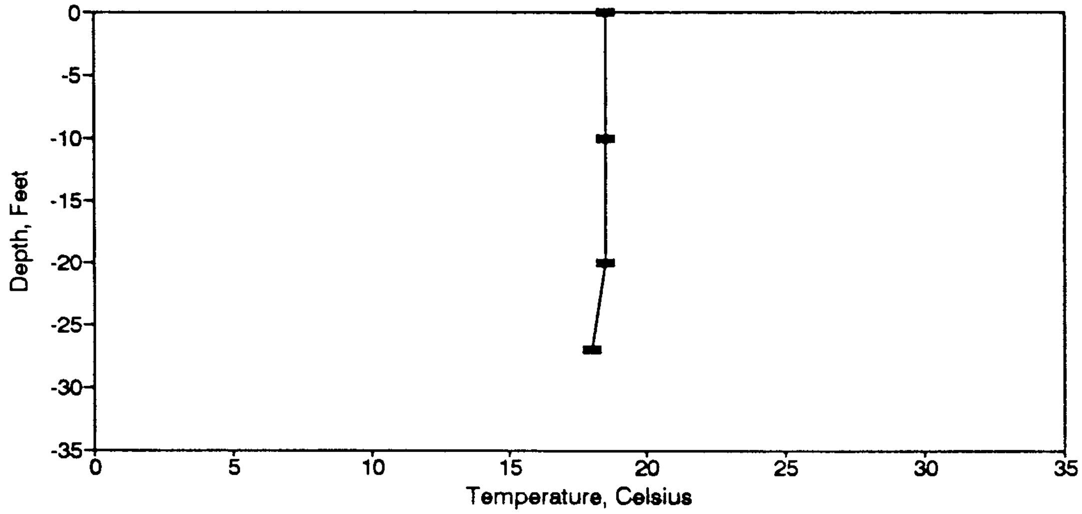

Figure BT48. Temperature Profile for the Waveland Site-October 11, 1984.

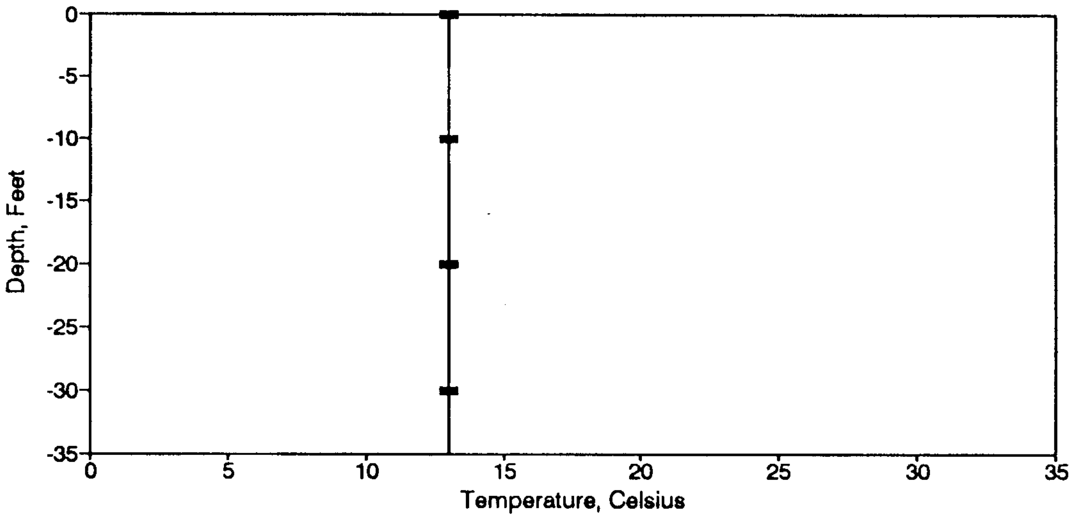

Figure BT49. Temperature Profile for the Waveland Site-November 21, 1984.

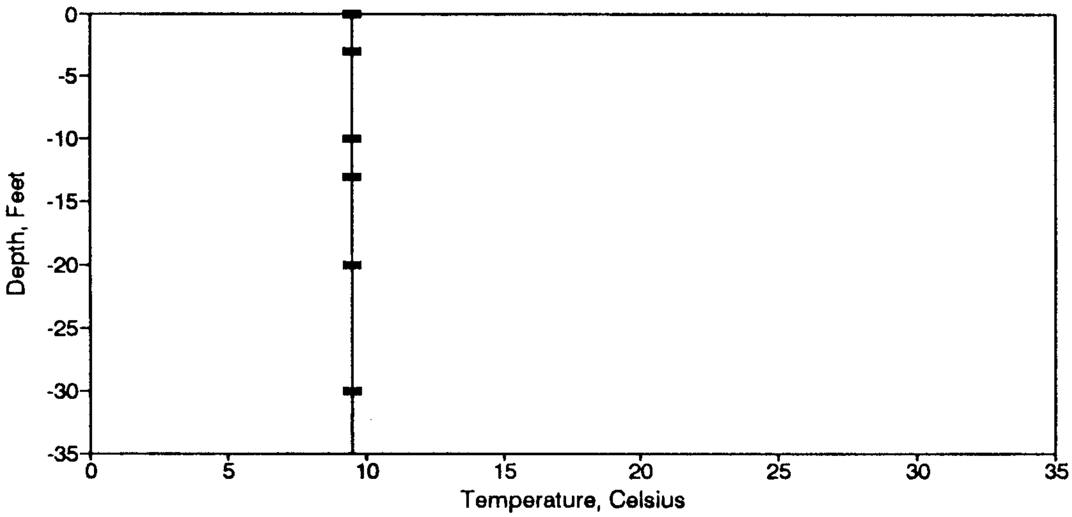

Figure BT50. Temperature Profile for the Waveland Site-December 20, 1984.

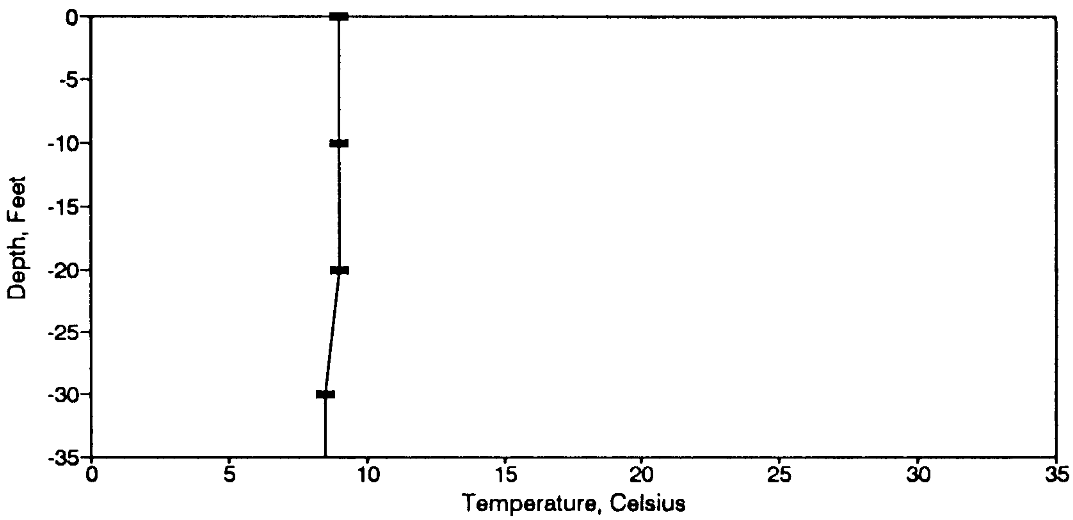

Figure BT51. Temperature Profile for the Waveland Site-February 26, 1985.

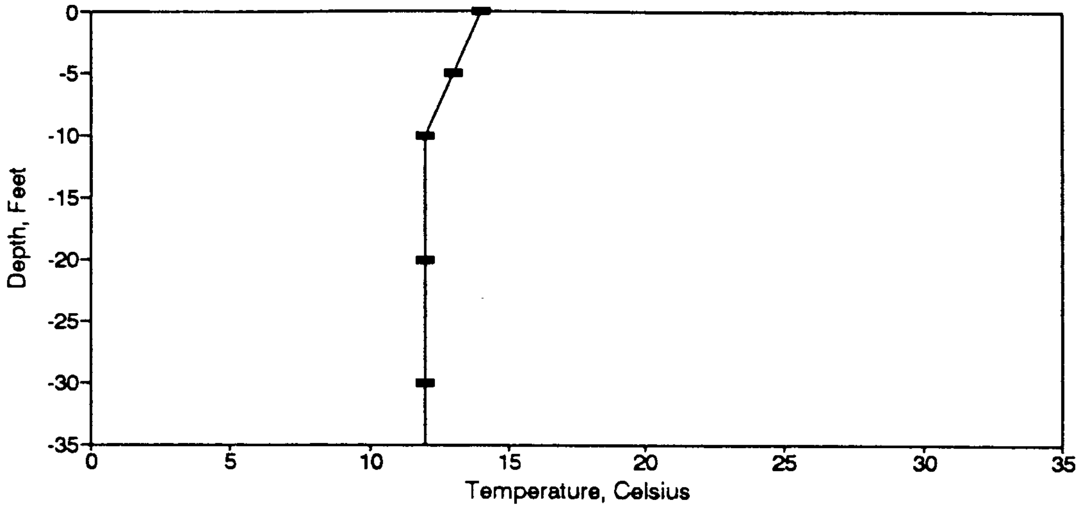

Figure BT52. Temperature Profile for the Waveland Site-March 19, 1985.

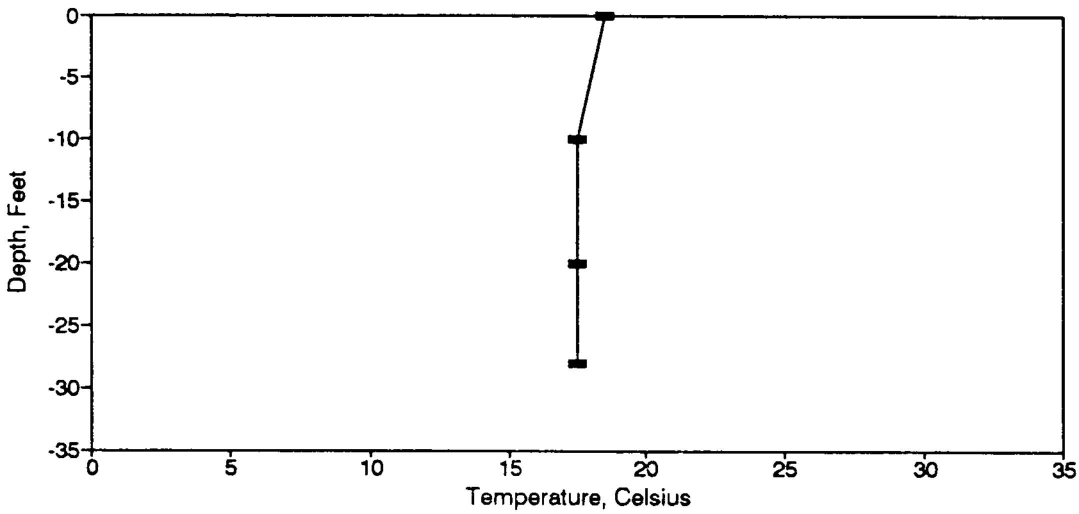

Figure BT53. Temperature Profile for the Waveland Site-April 23, 1985.

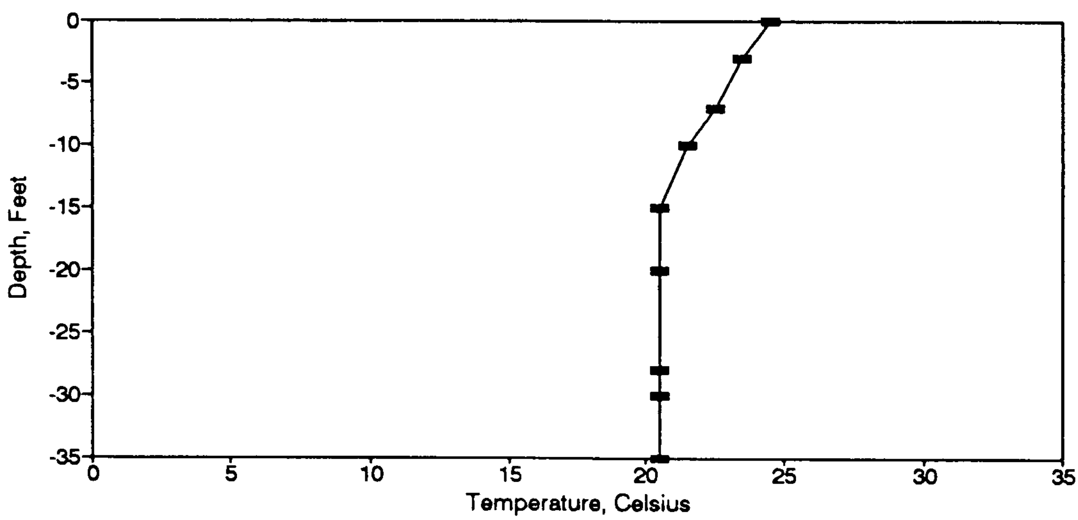

Figure BT54. Temperature Profile for the Waveland Site-May 28, 1985.

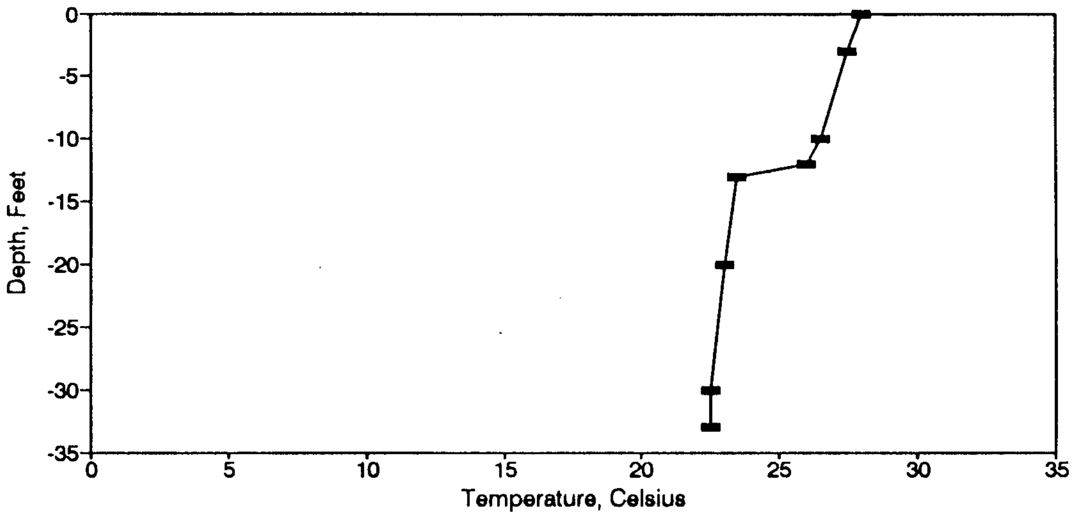

Figure BT55. Temperature Profile for the Waveland Site-June 17, 1985.

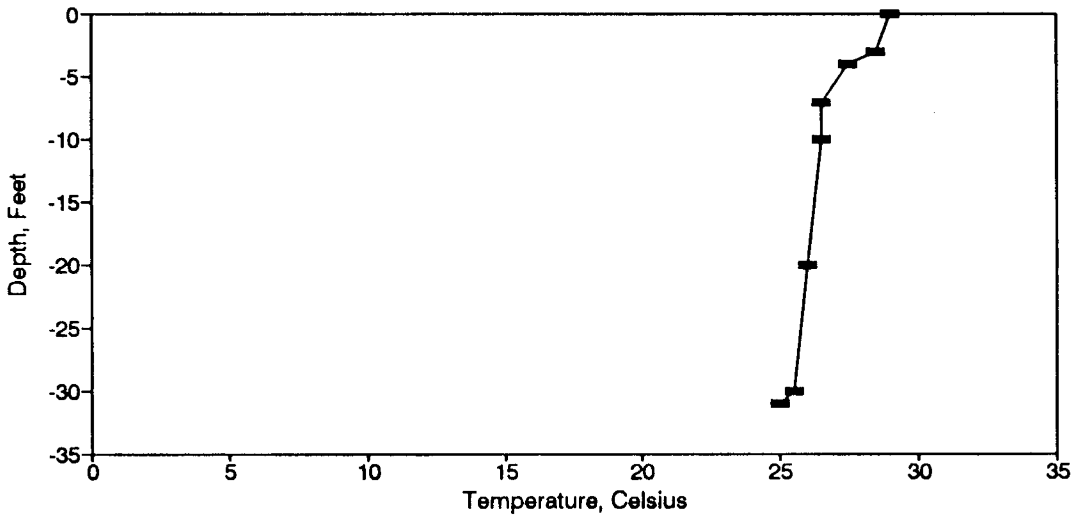

Figure BT56. Temperature Profile for the Waveland Site-July 22, 1985.

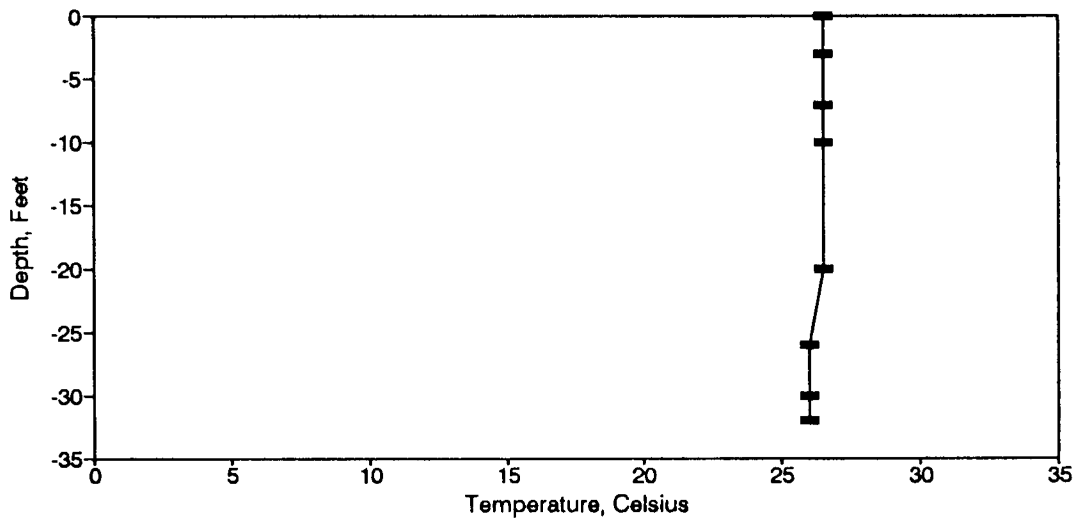

Figure BT57. Temperature Profile for the Waveland Site-August 23, 1985.

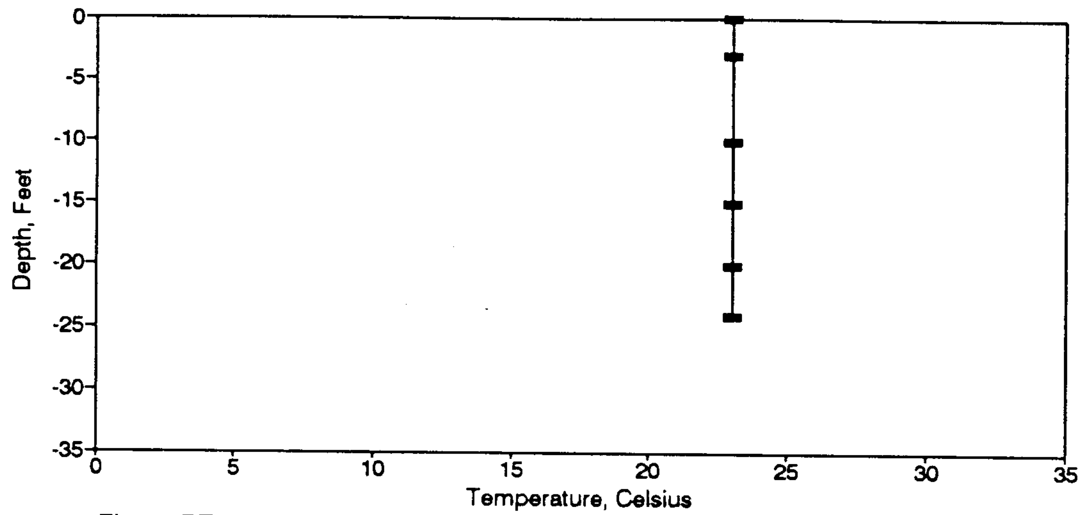

Figure BT58. Temperature Profile for the Waveland Site-September 23, 1985.

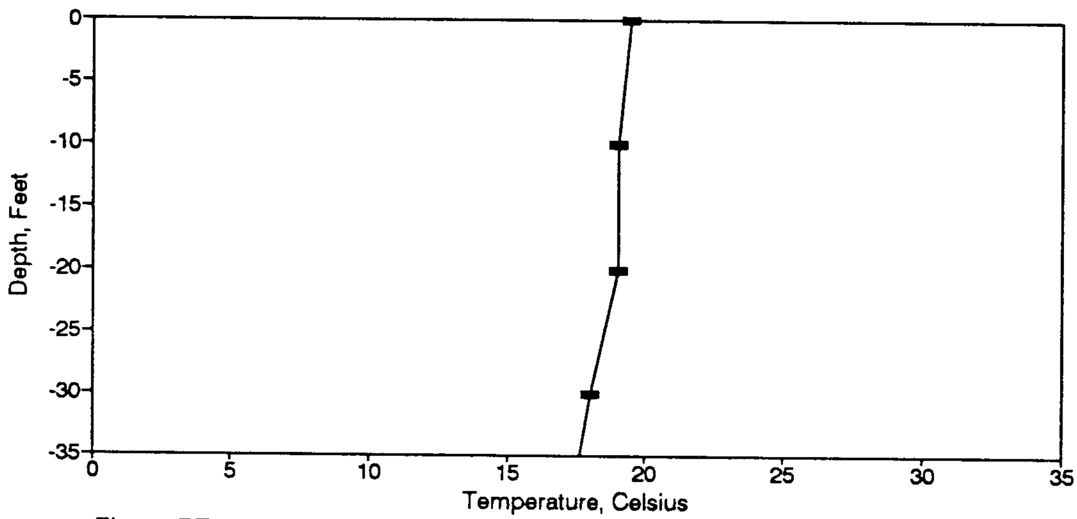

Figure BT59. Temperature Profile for the Waveland Site-October 16, 1985.

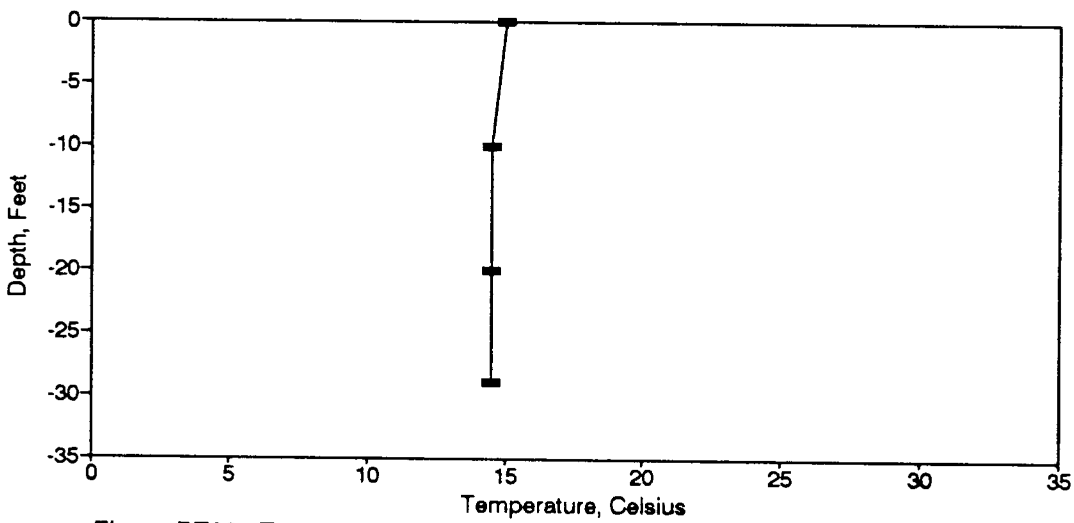

Figure BT60. Temperature Profile for the Waveland Site-November 18, 1985.

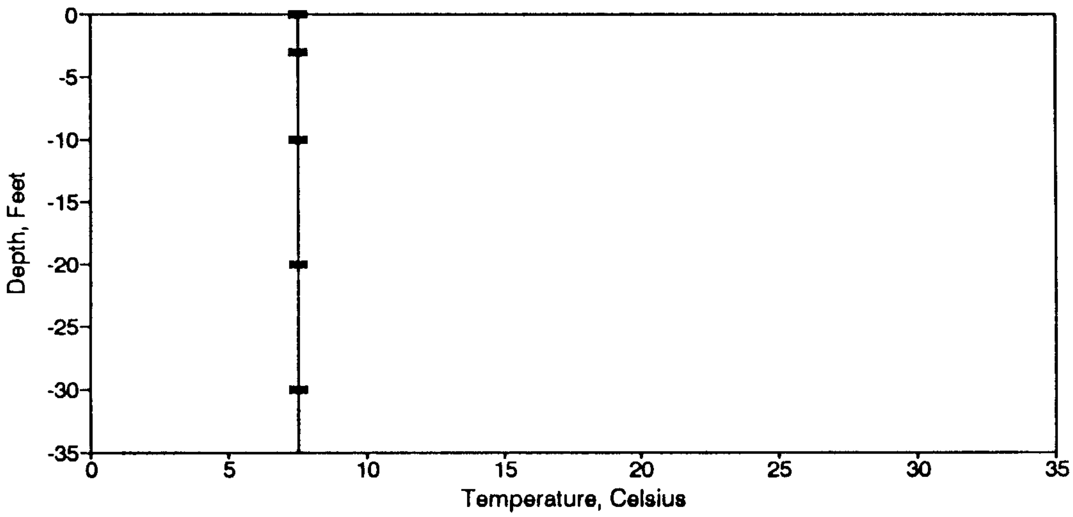

Figure BT61. Temperature Profile for the Waveland Site-December 12, 1985.

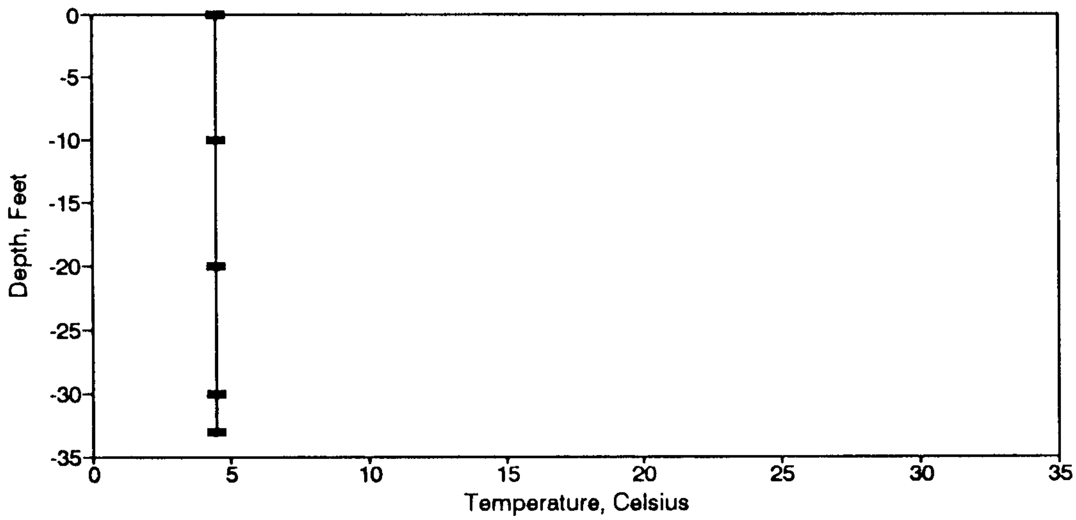

Figure BT62. Temperature Profile for the Waveland Site-January 14, 1986.

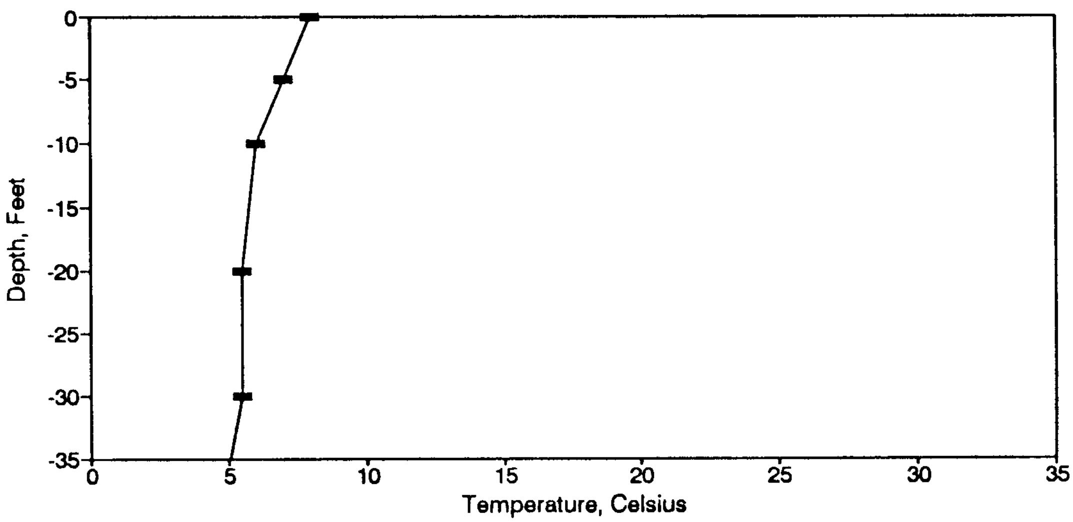

Figure BT63. Temperature Profile for the Waveland Site-February 3, 1986.

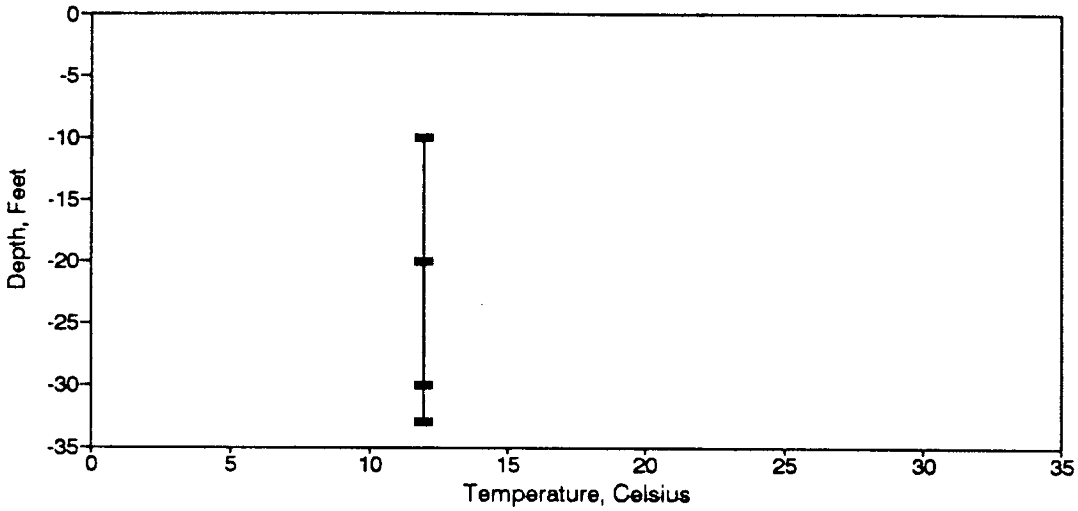

Figure BT64. Temperature Profile for the Waveland Site-March 11, 1986.

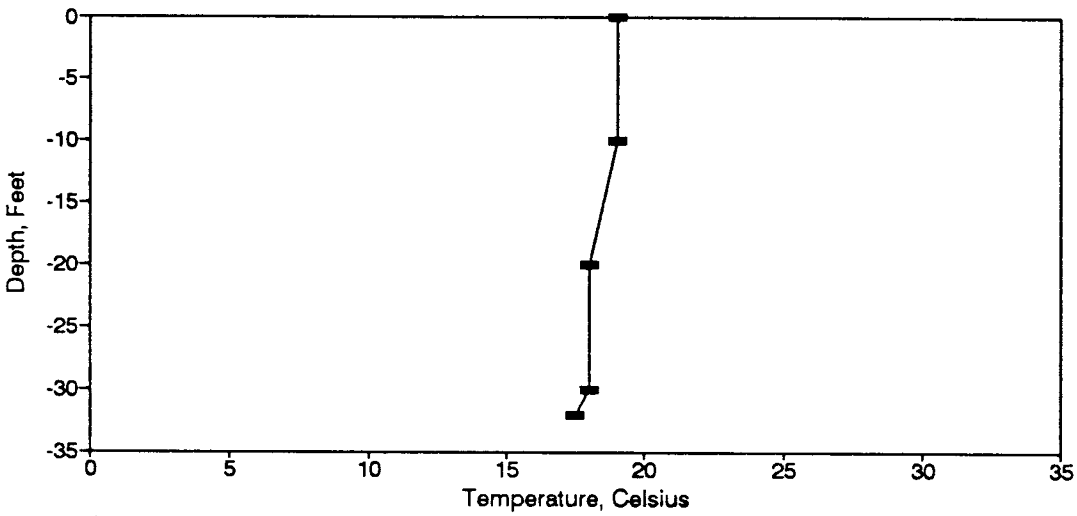

Figure BT65. Temperature Profile for the Waveland Site-April 14, 1986.

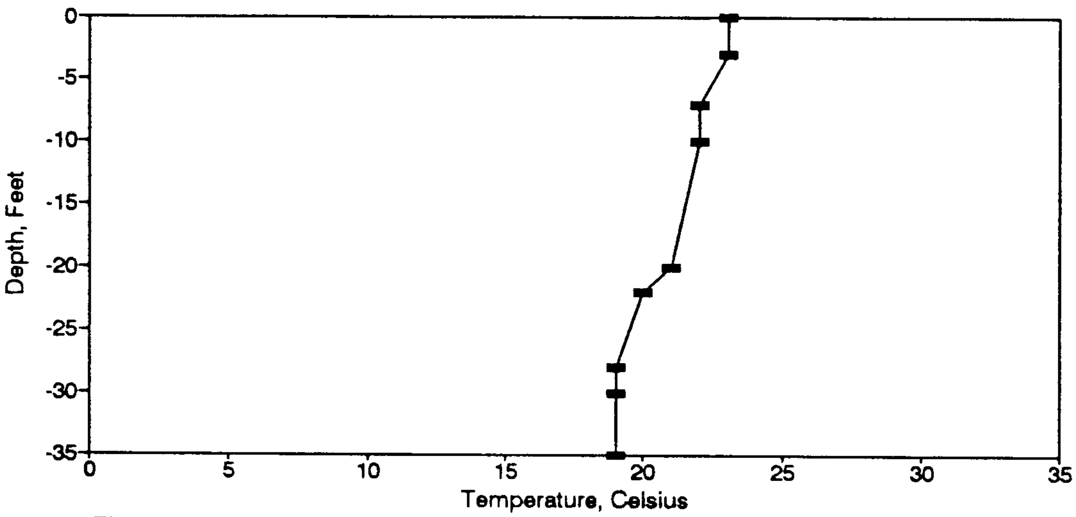

Figure BT66. Temperature Profile for the Waveland Site-May 15, 1986.

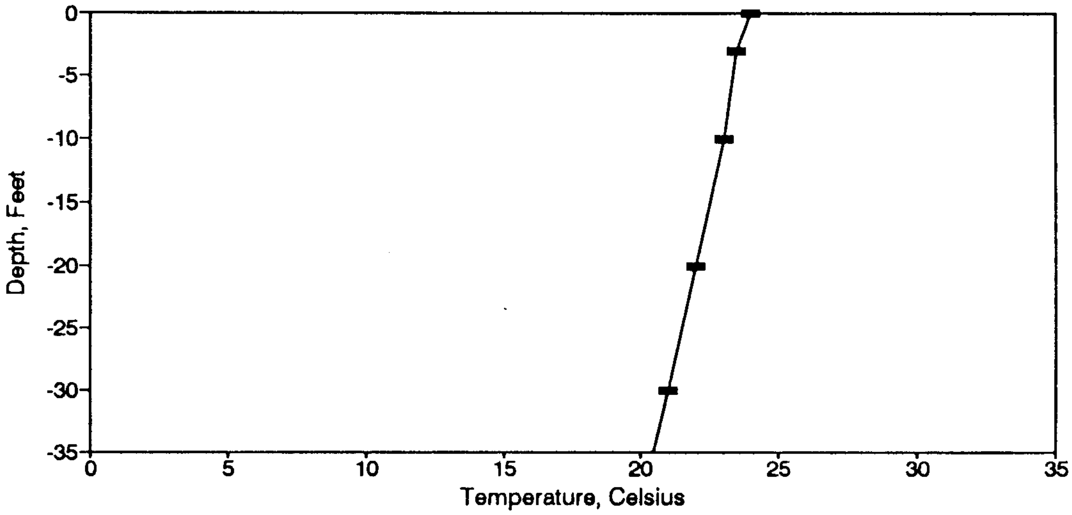

Figure BT67. Temperature Profile for the Waveland Site-June 9, 1986.

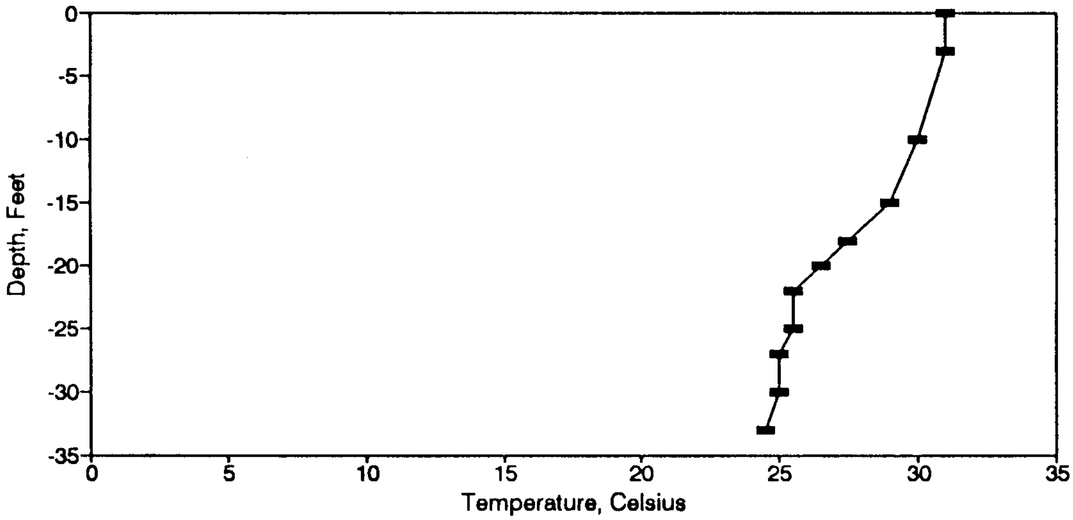

Figure BT68. Temperature Profile for the Waveland Site-July 15, 1986.

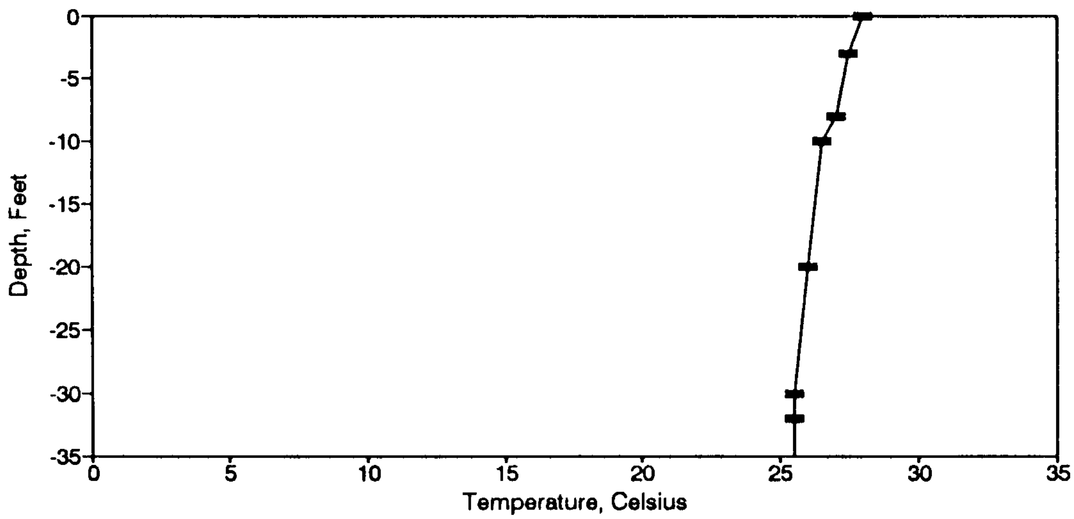

Figure BT69. Temperature Profile for the Waveland Site-August 21, 1986.

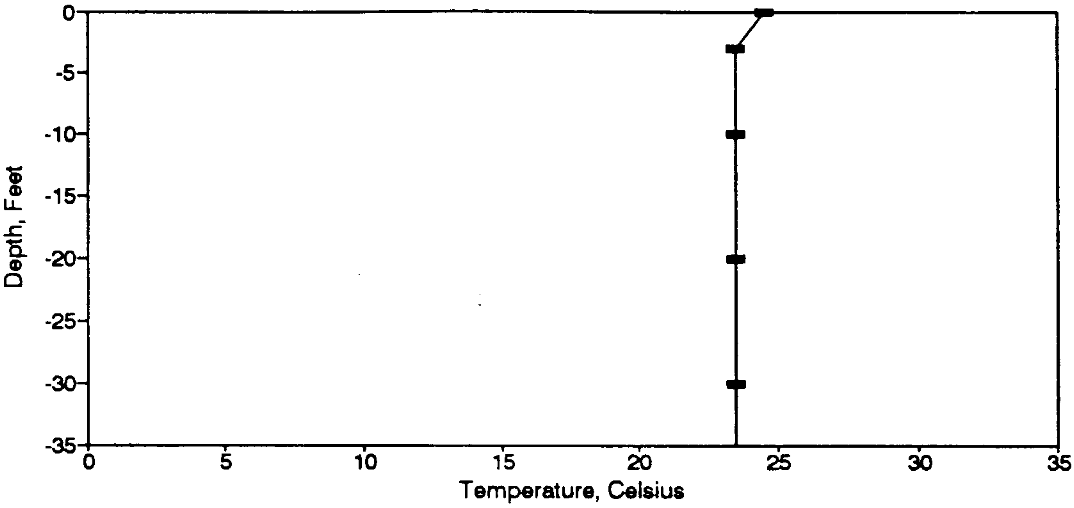

Figure BT70. Temperature Profile for the Waveland Site-September 10, 1986.

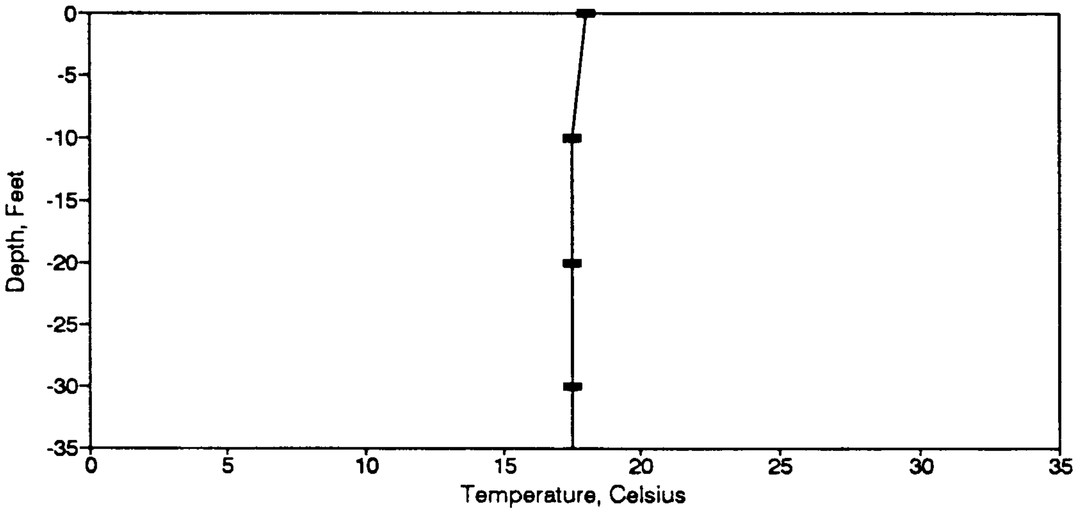

Figure BT71. Temperature Profile for the Waveland Site-October 14, 1986.

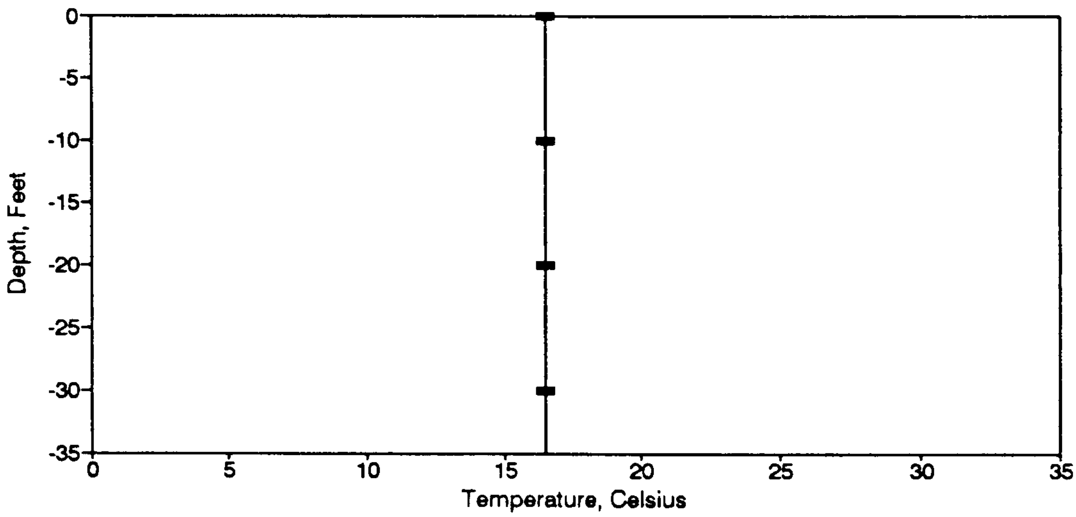

Figure BT72. Temperature Profile for the Waveland Site-November 3, 1986.

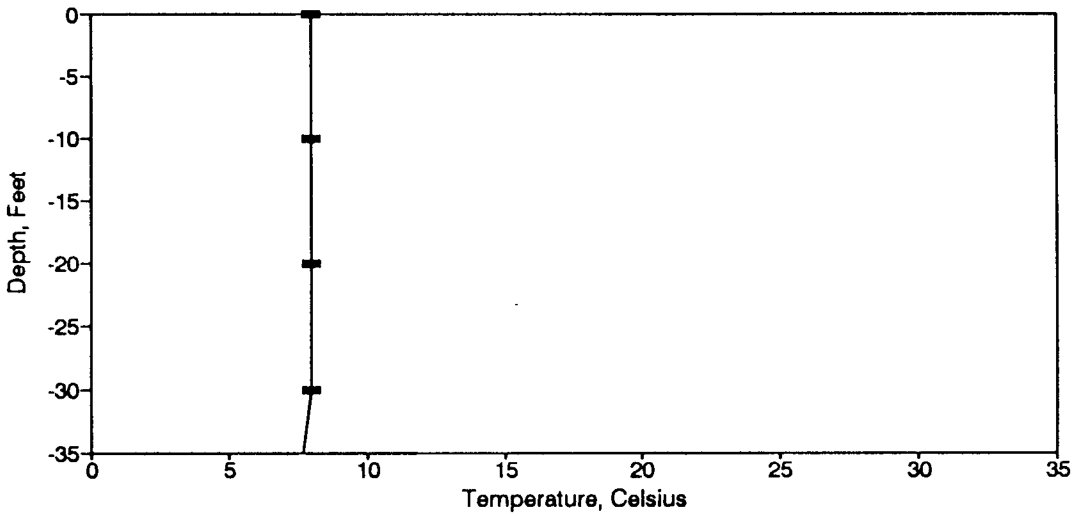

Figure BT73. Temperature Profile for the Waveland Site-December 8, 1986.

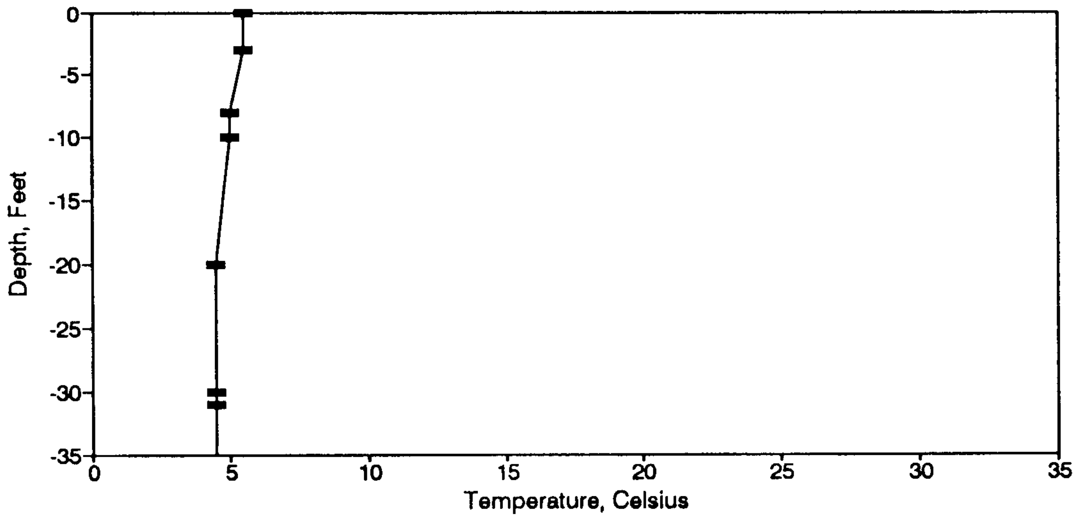

Figure BT74. Temperature Profile for the Waveland Site-January 15, 1987.

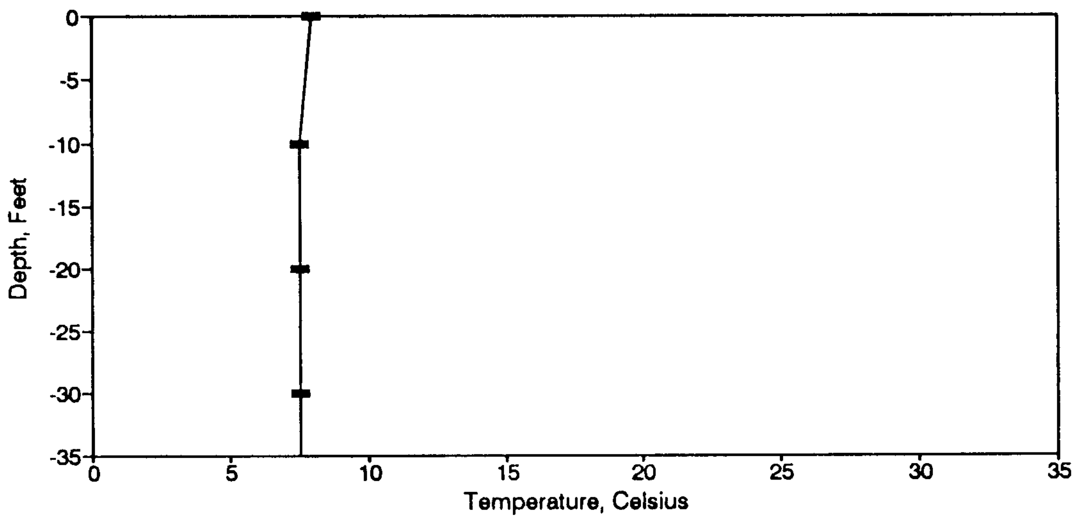

Figure BT75. Temperature Profile for the Waveland Site-February 10, 1987.

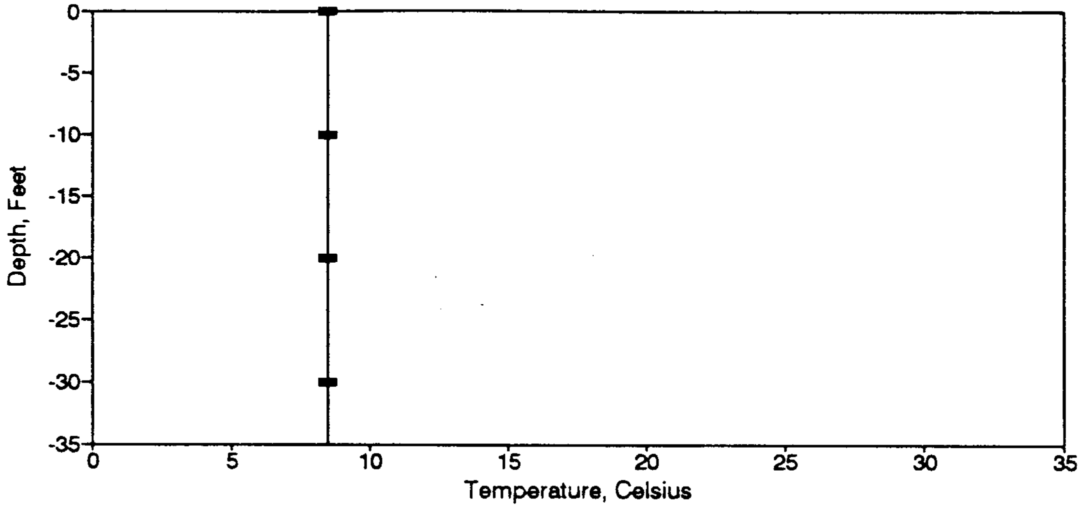

Figure BT76. Temperature Profile for the Waveland Site-March 2, 1987.

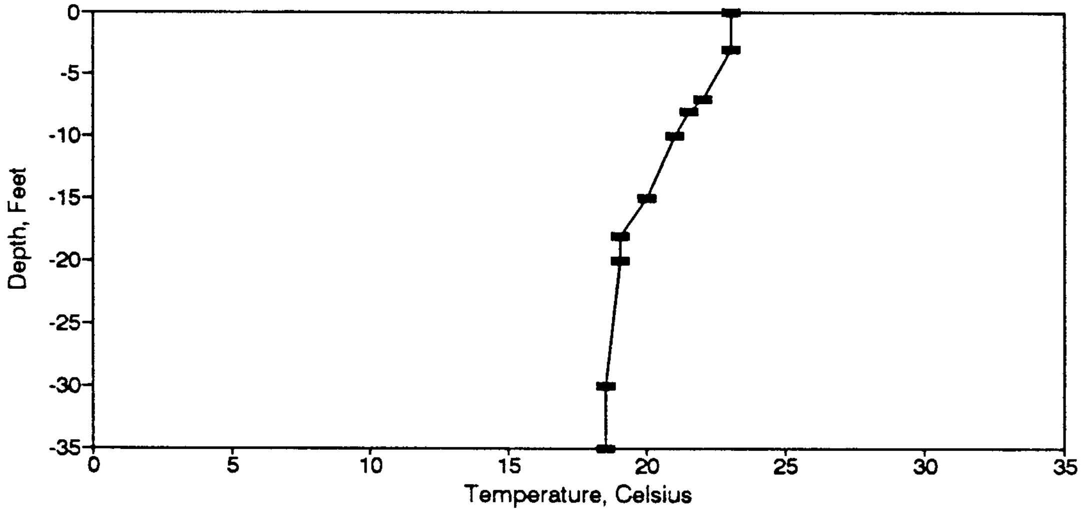

Figure BT77. Temperature Profile for the Waveland Site-April 30, 1987.

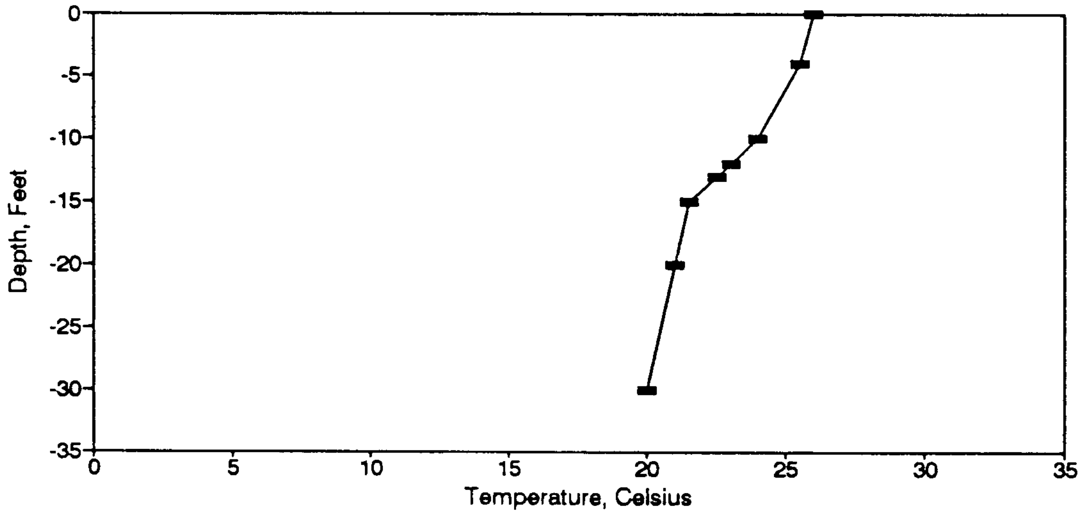

Figure BT78. Temperature Profile for the Waveland Site-May 15, 1987.

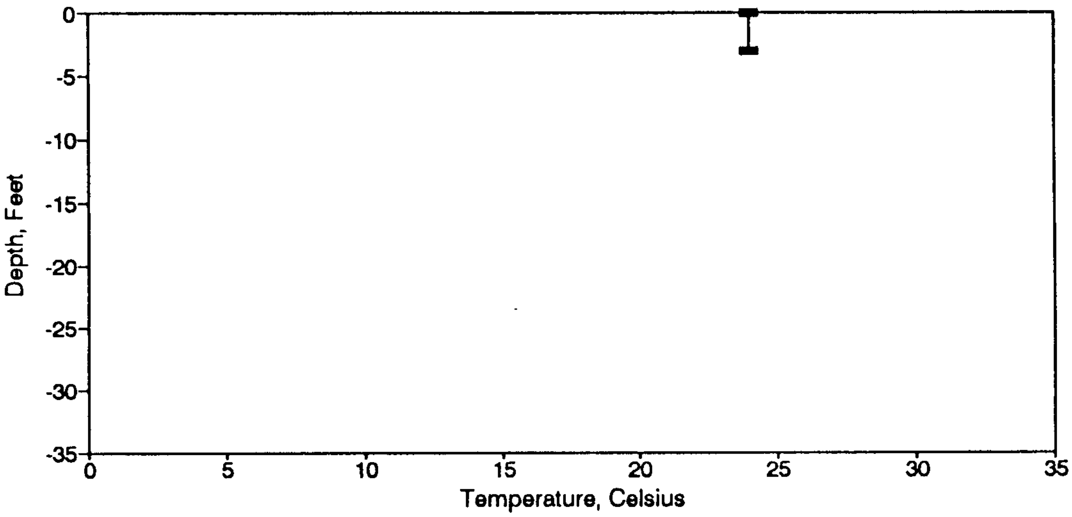

Figure BT79. Temperature Profile for the Waveland Site-June 1, 1987.

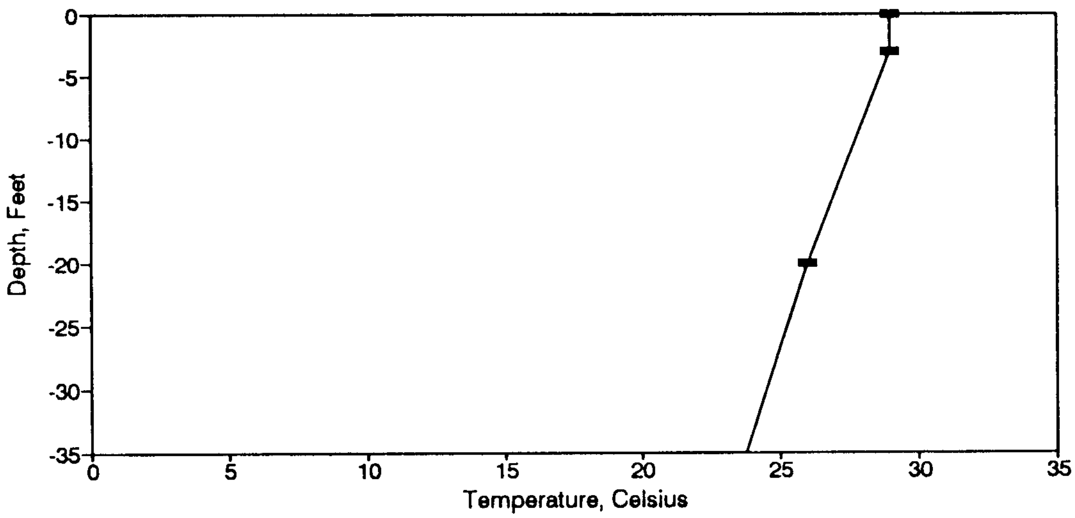

Figure BT80. Temperature Profile for the Waveland Site-July 6, 1987.

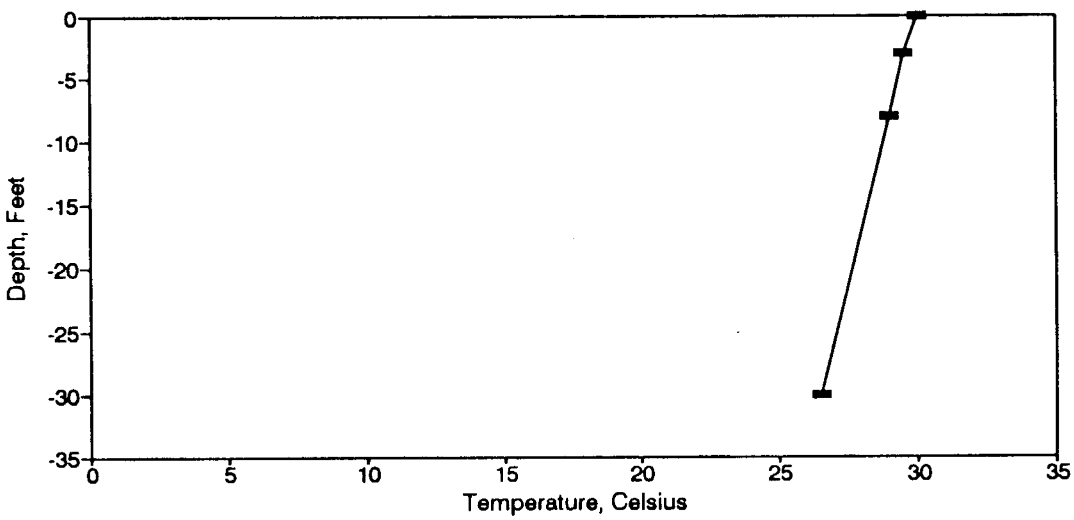

Figure BT81. Temperature Profile for the Waveland Site-August 6, 1987.

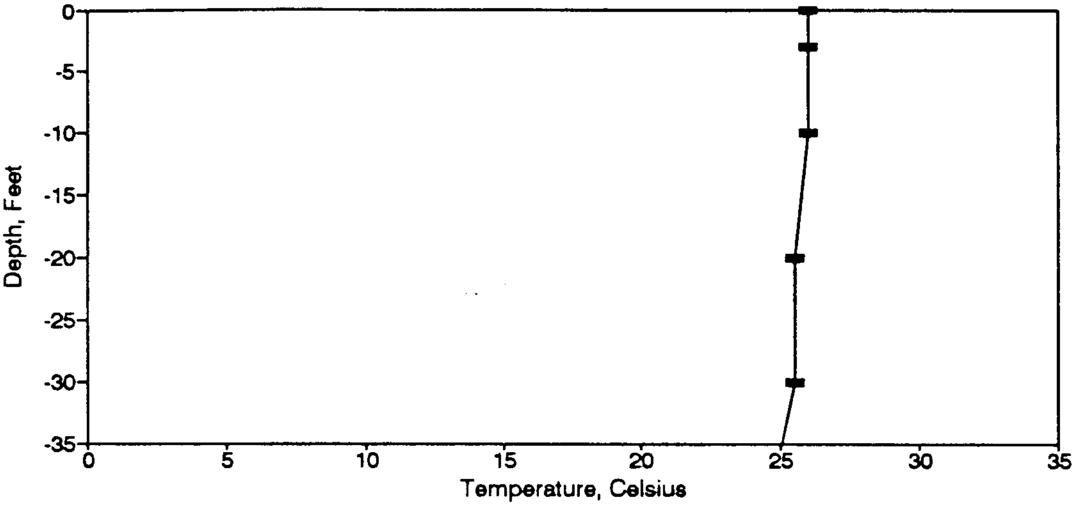

Figure BT82. Temperature Profile for the Waveland Site-September 2, 1987.

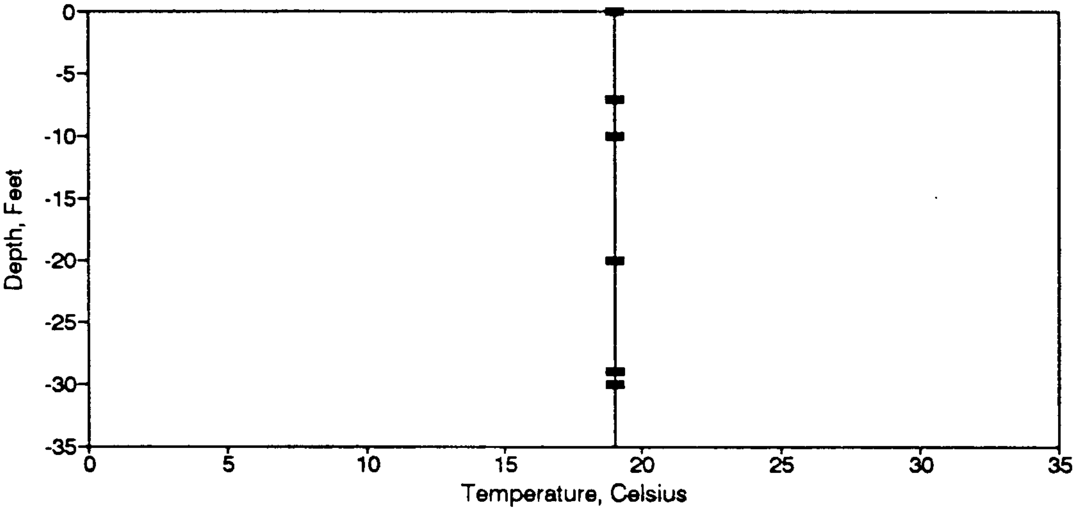

Figure BT83. Temperature Profile for the Waveland Site-October 6, 1987.

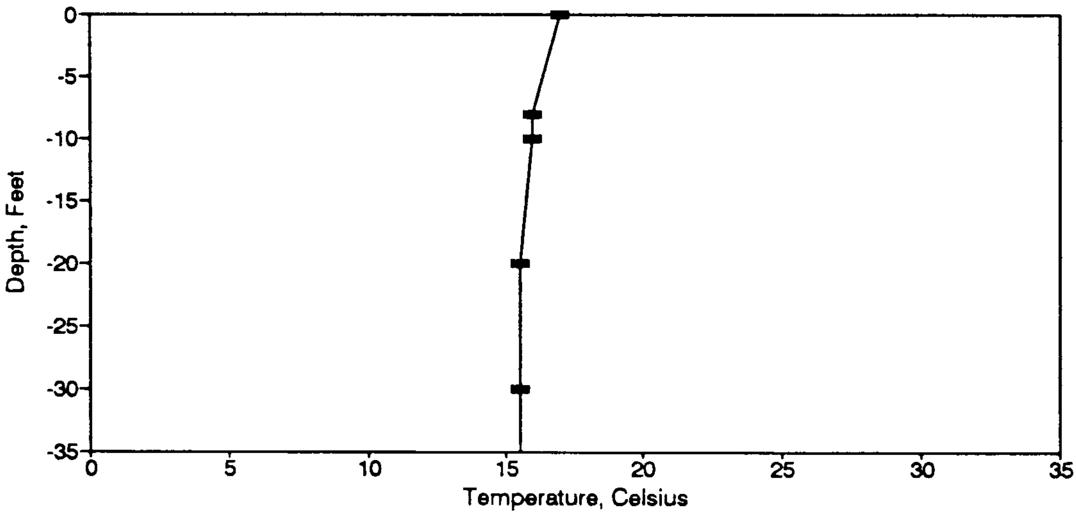

Figure BT84. Temperature Profile for the Waveland Site-November 2, 1987.

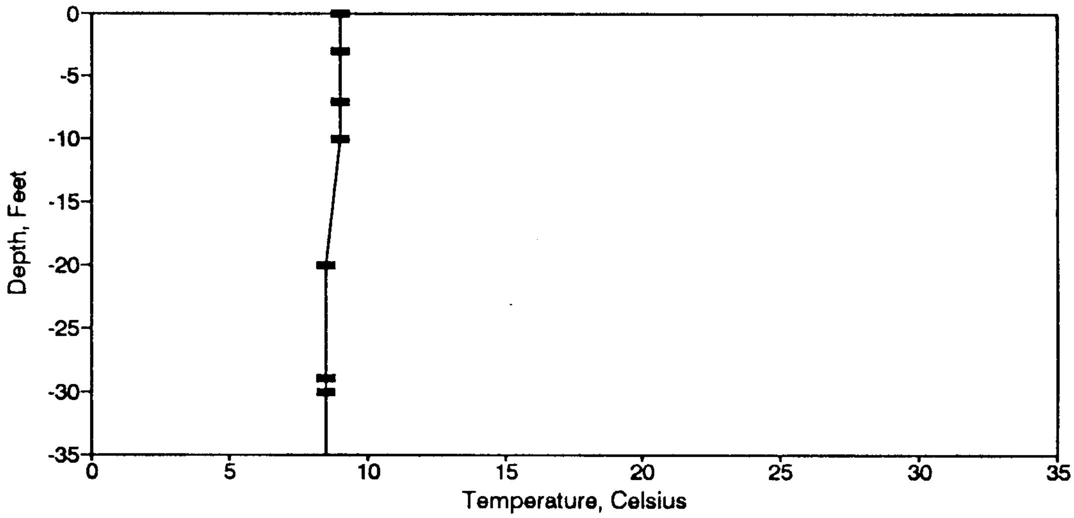

Figure BT85. Temperature Profile for the Waveland Site-December 3, 1987.

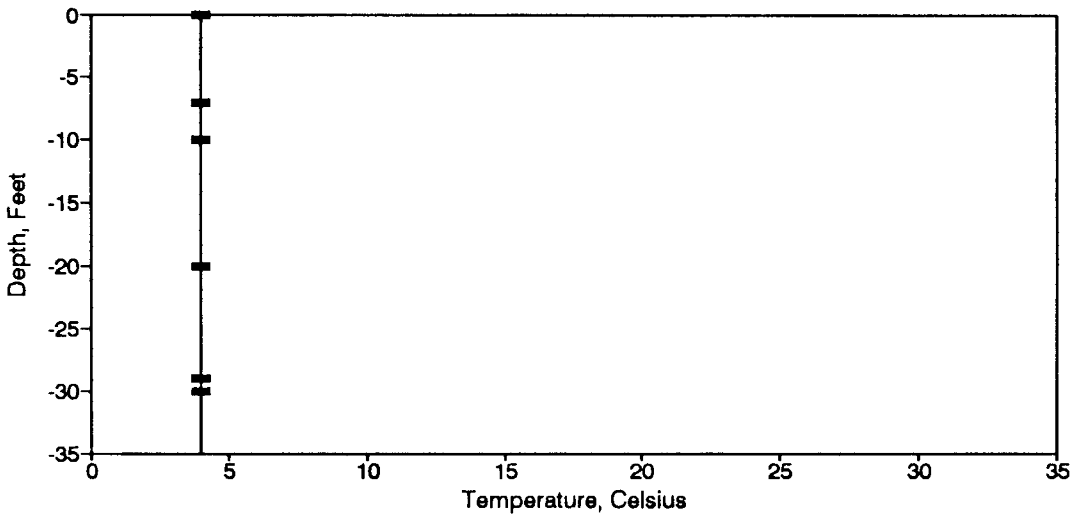

Figure BT86. Temperature Profile for the Waveland Site-January 25, 1988.

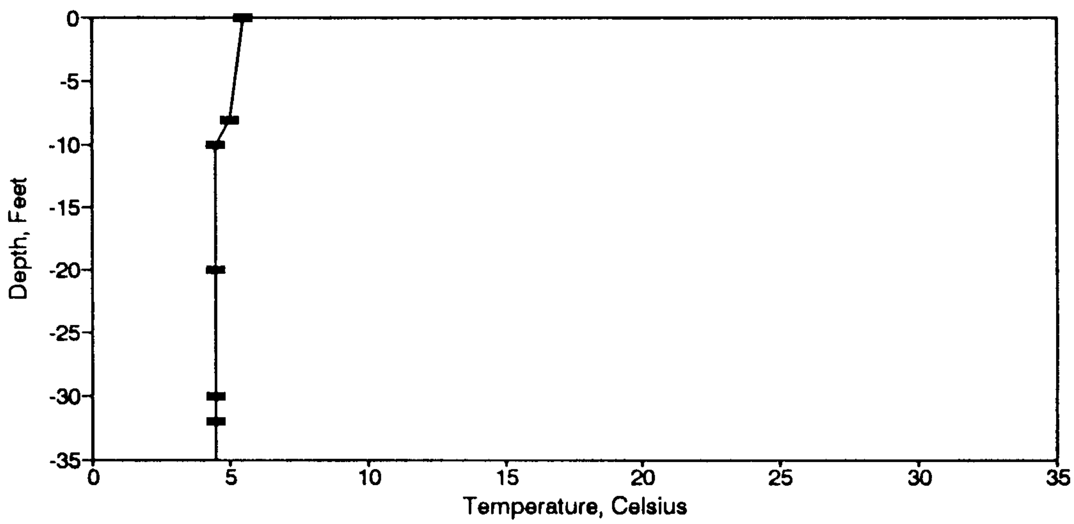

Figure BT87. Temperature Profile for the Waveland Site-February 16, 1988.

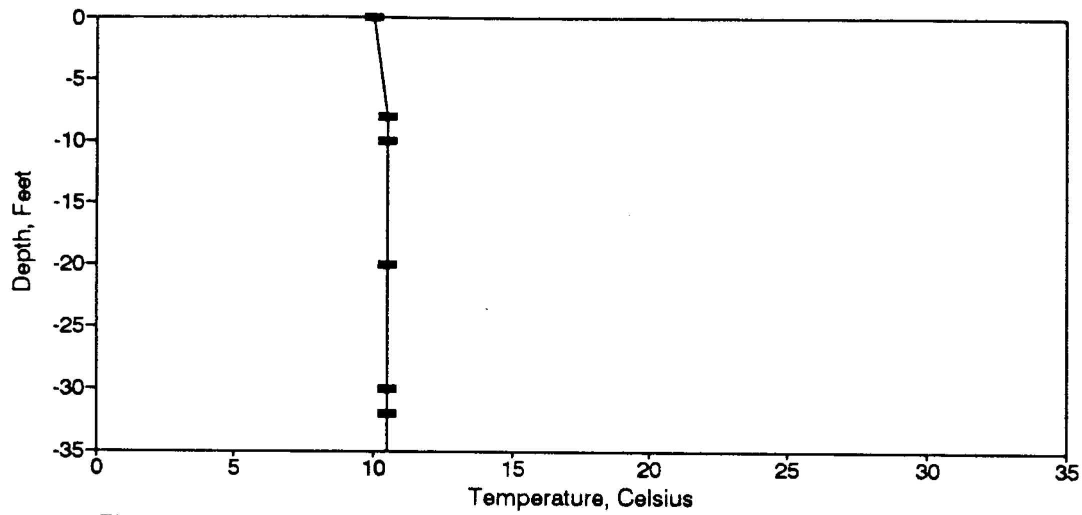

Figure BT88. Temperature Profile for the Waveland Site-March 9, 1988.

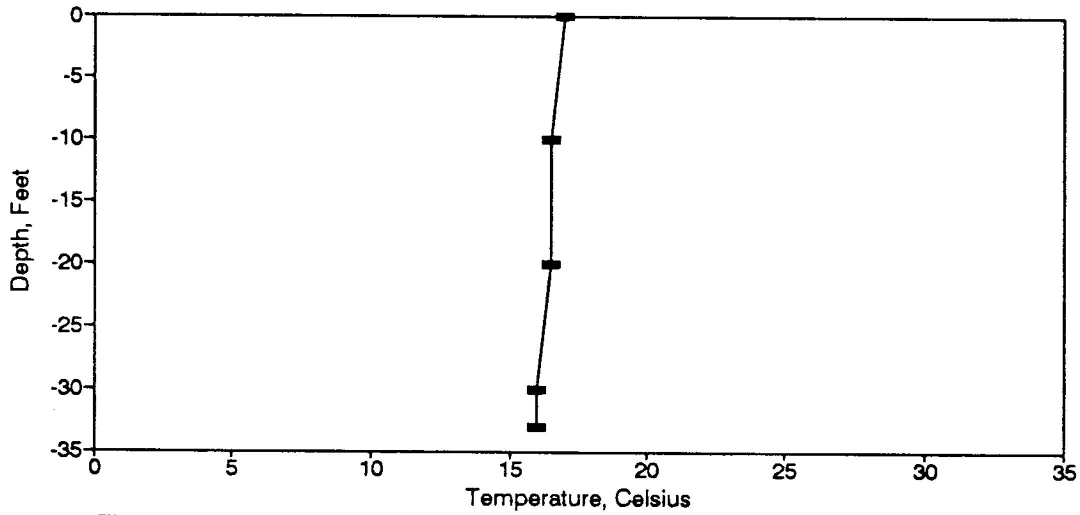

Figure BT89. Temperature Profile for the Waveland Site-April 25, 1988.

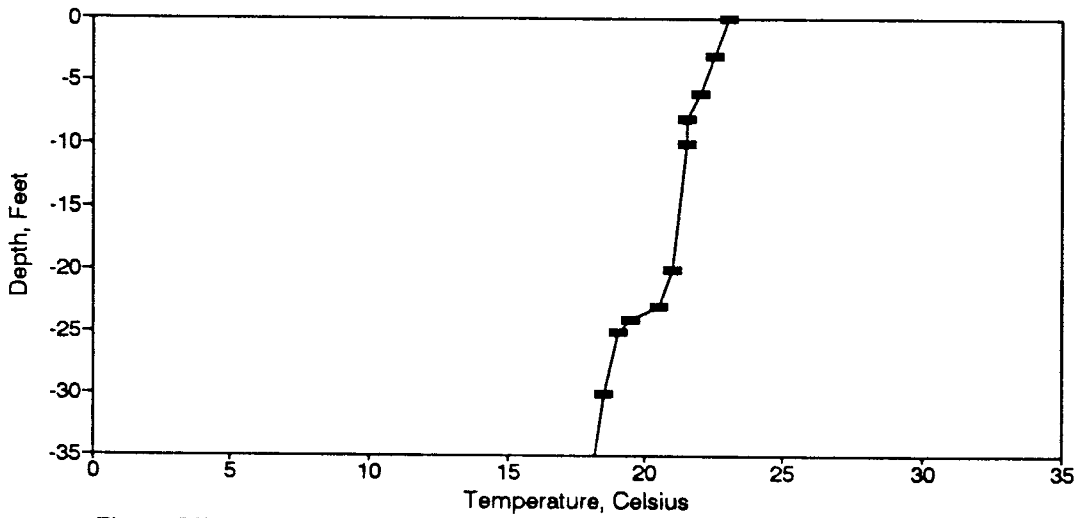

Figure BT90. Temperature Profile for the Waveland Site-May 12, 1988.

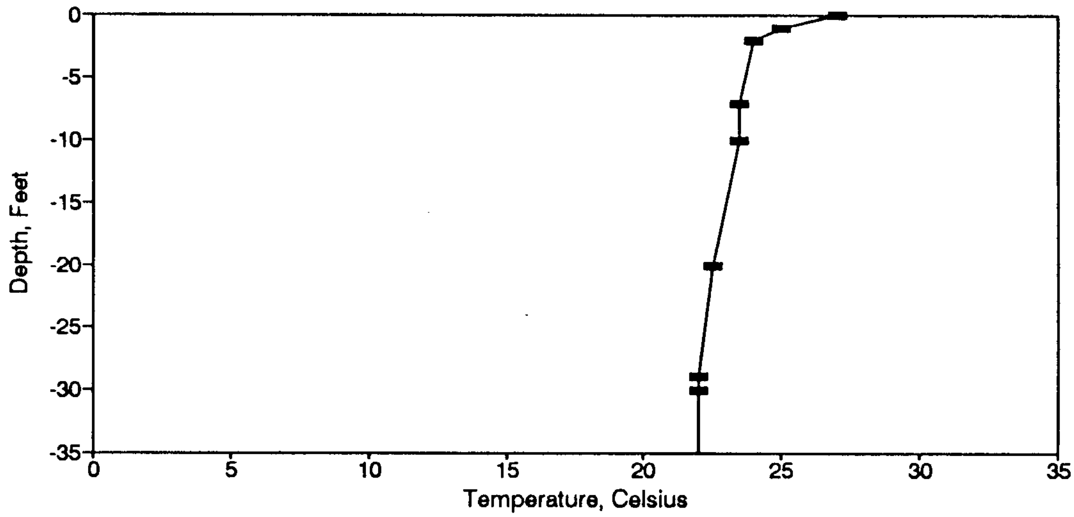

Figure BT91. Temperature Profile for the Waveland Site-June 15, 1988.

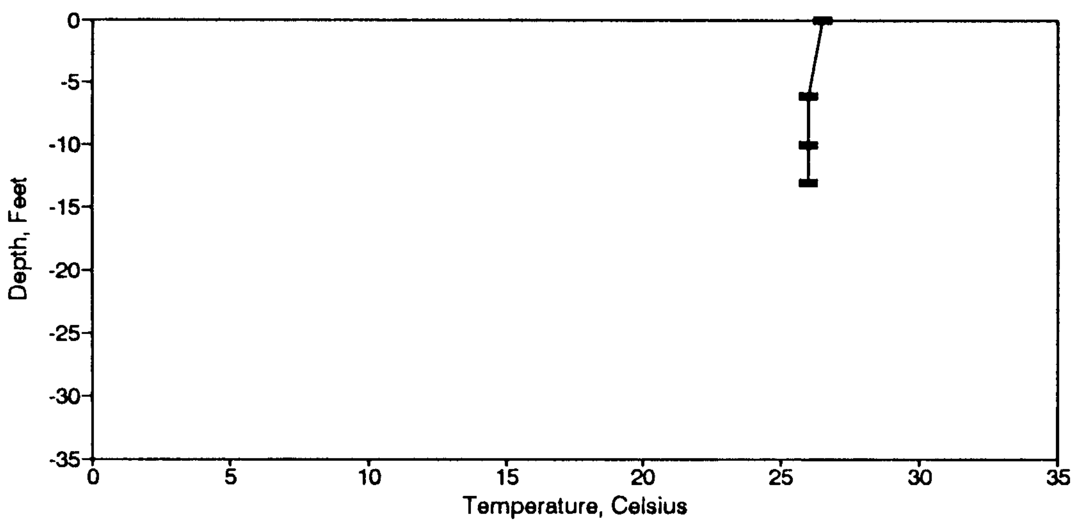

Figure BT92. Temperature Profile for the Waveland Site-July 6, 1988.

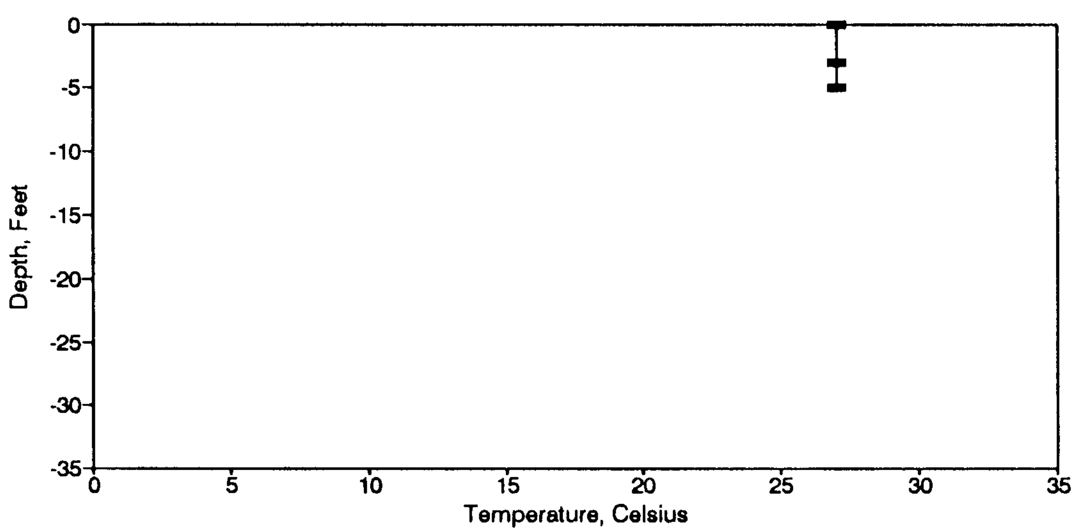

Figure BT93. Temperature Profile for the Waveland Site-August 11, 1988.

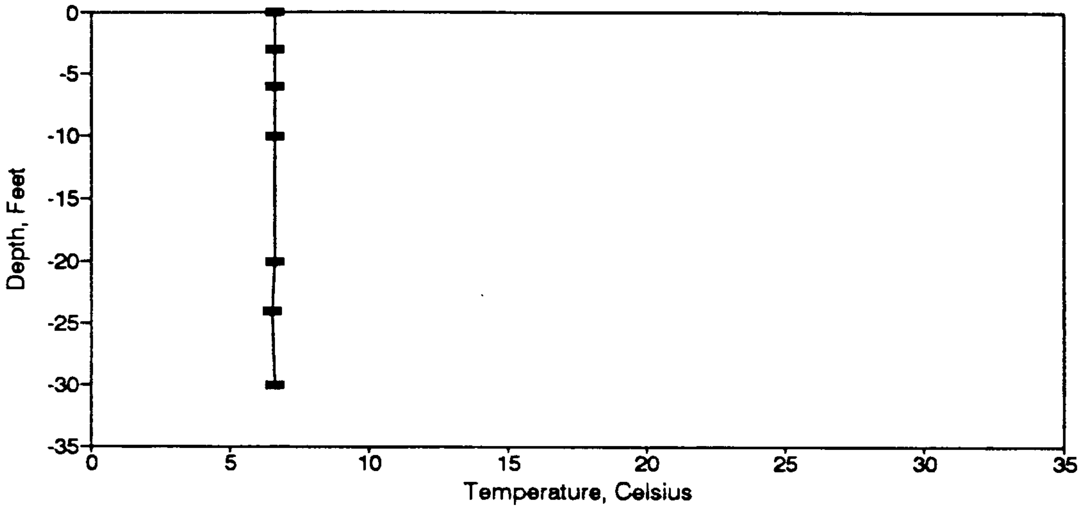

Figure BT94. Temperature Profile for the Waveland Site-January 12, 1989.

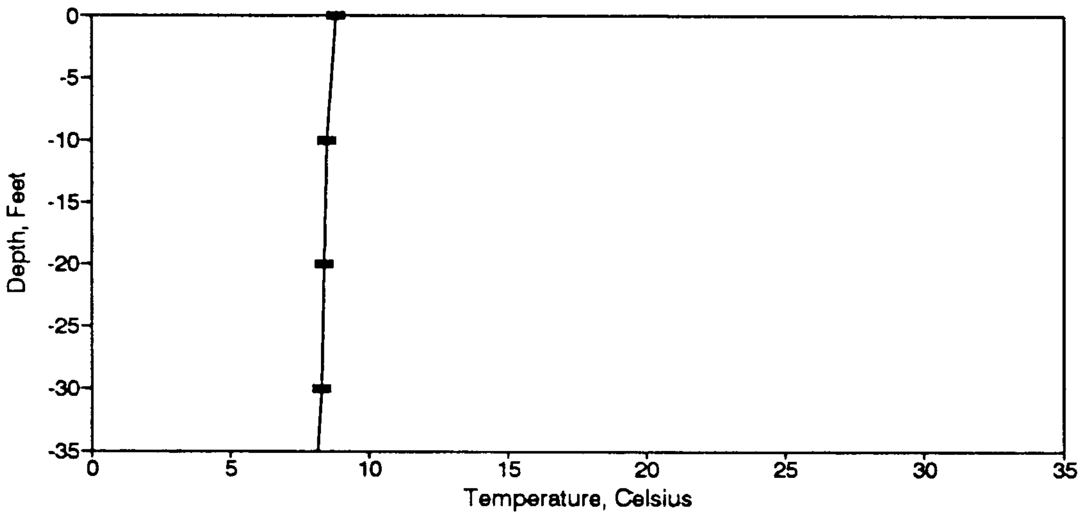

Figure BT95. Temperature Profile for the Waveland Site-February 1, 1989.

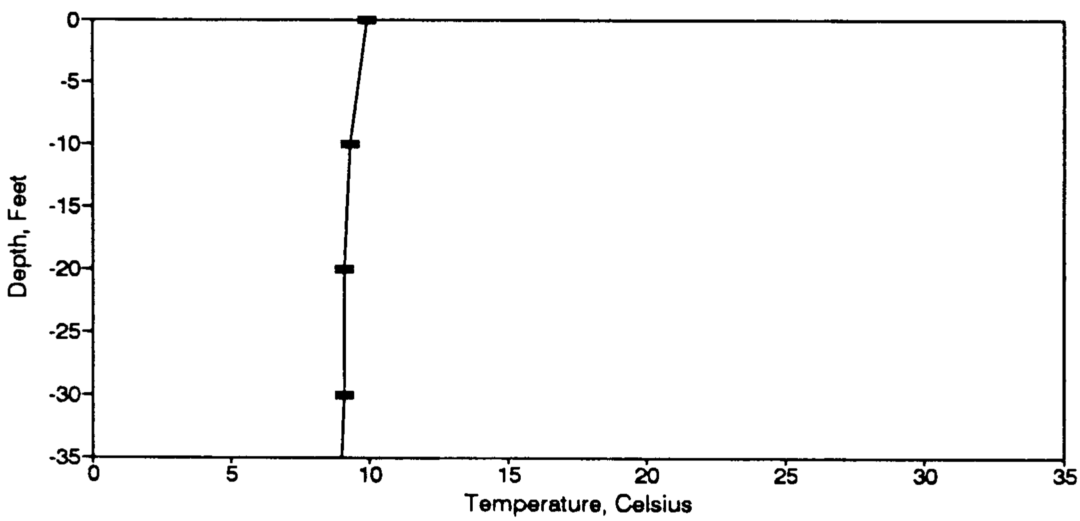

Figure BT96. Temperature Profile for the Waveland Site-March 20, 1989.

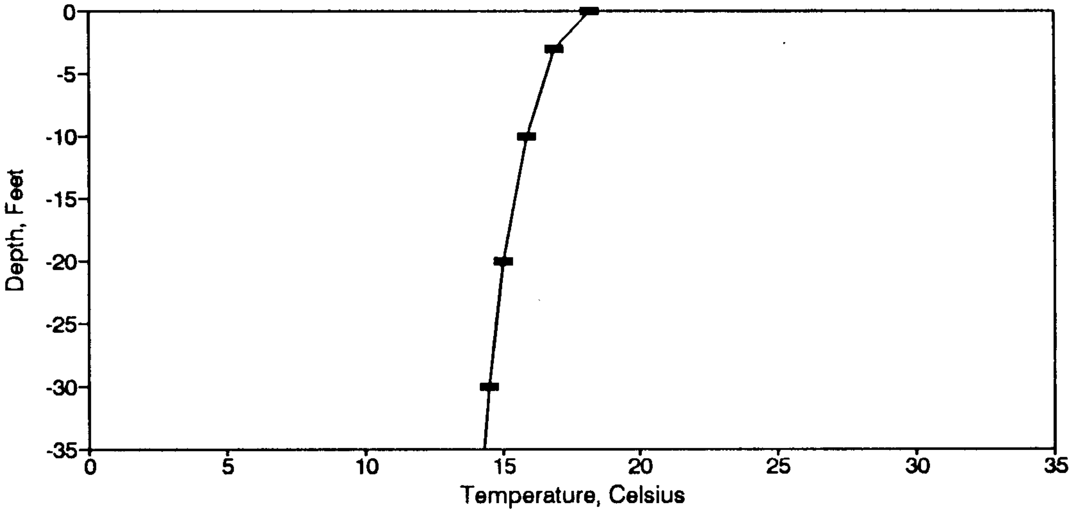

Figure BT97. Temperature Profile for the Waveland Site-April 17, 1989.

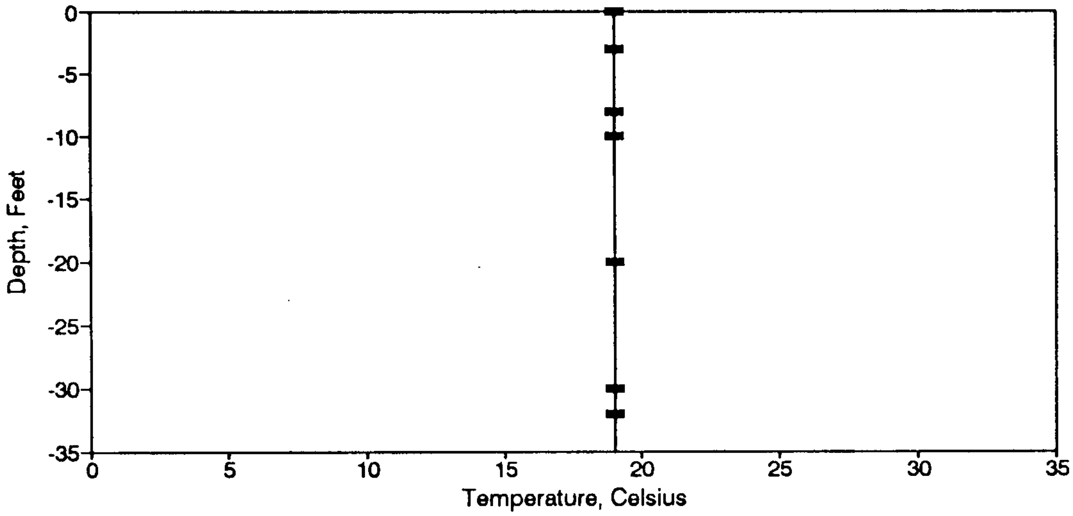

Figure BT98. Temperature Profile for the Waveland Site-May 11, 1989.

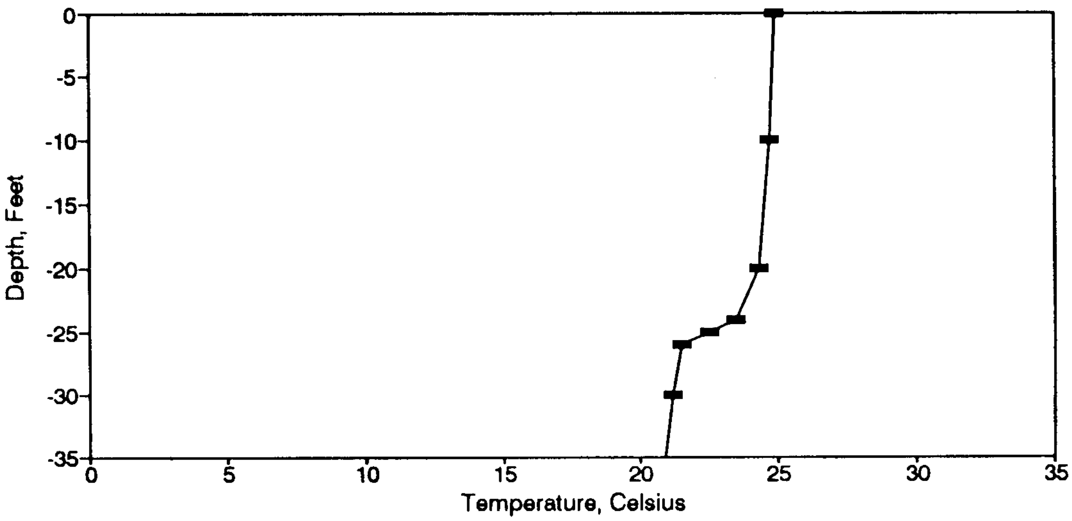

Figure BT99. Temperature Profile for the Waveland Site-June 19, 1989.

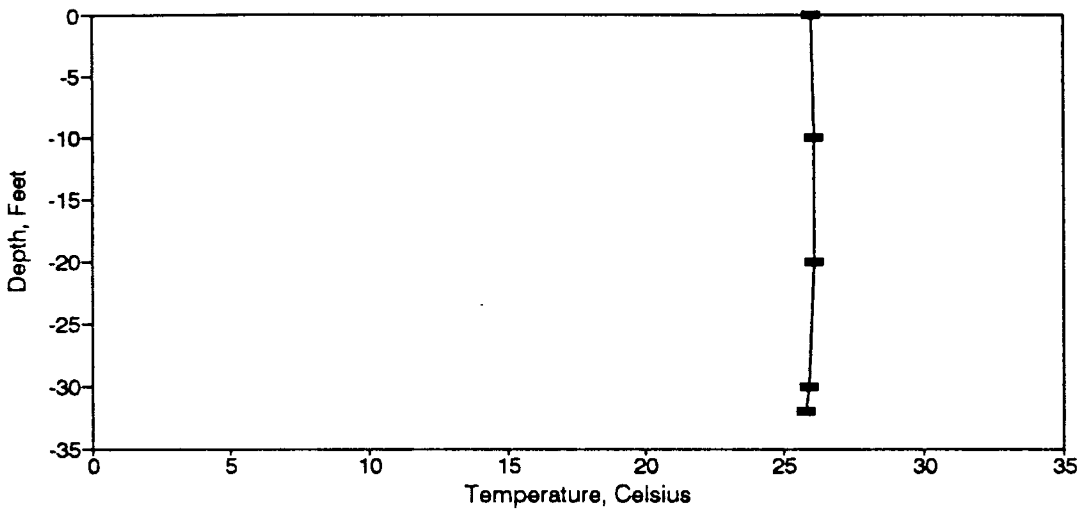

Figure BT100. Temperature Profile for the Waveland Site-July 17, 1989.

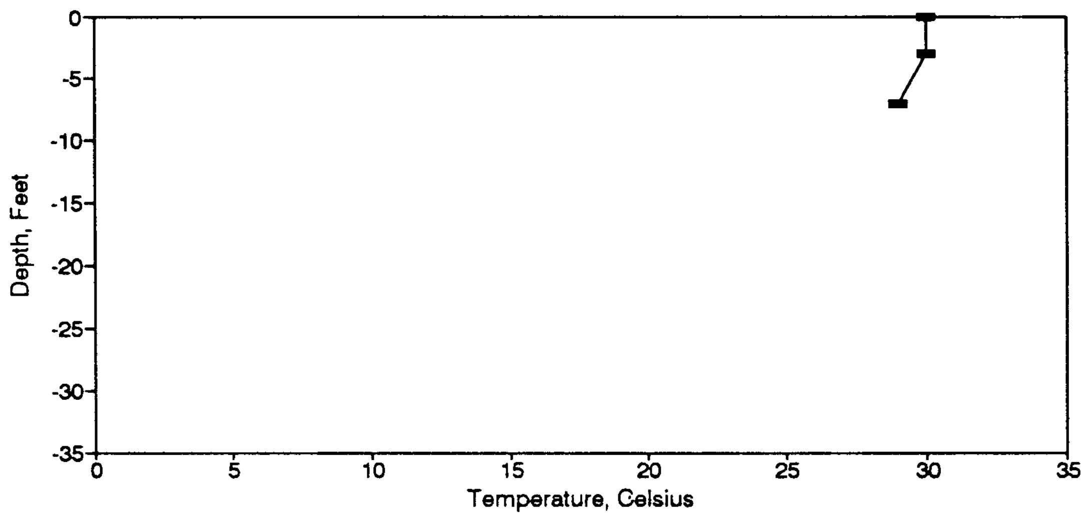

Figure BT101. Temperature Profile for the Waveland Site-August 7, 1989.

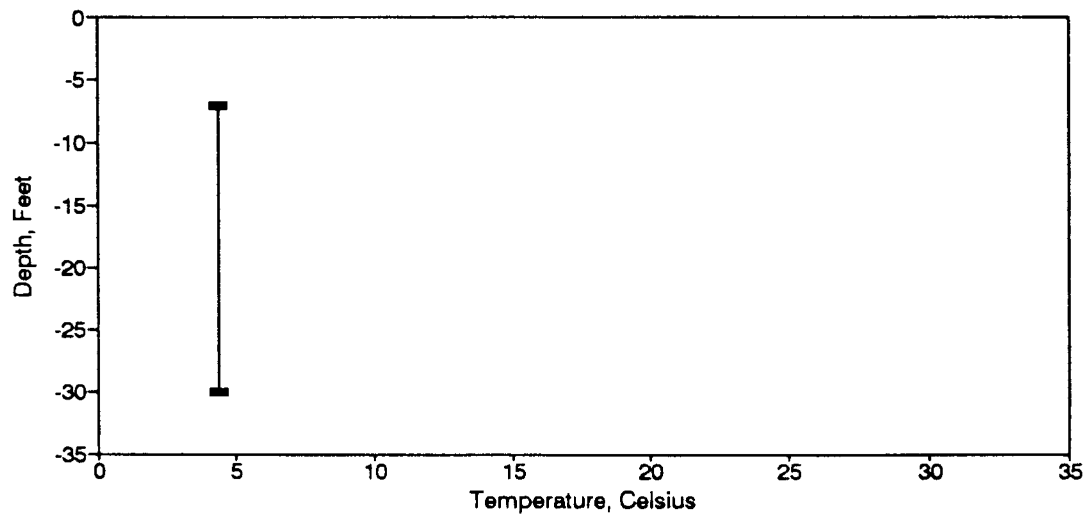

Figure BT102. Temperature Profile for the Waveland Site-December 13, 1989.

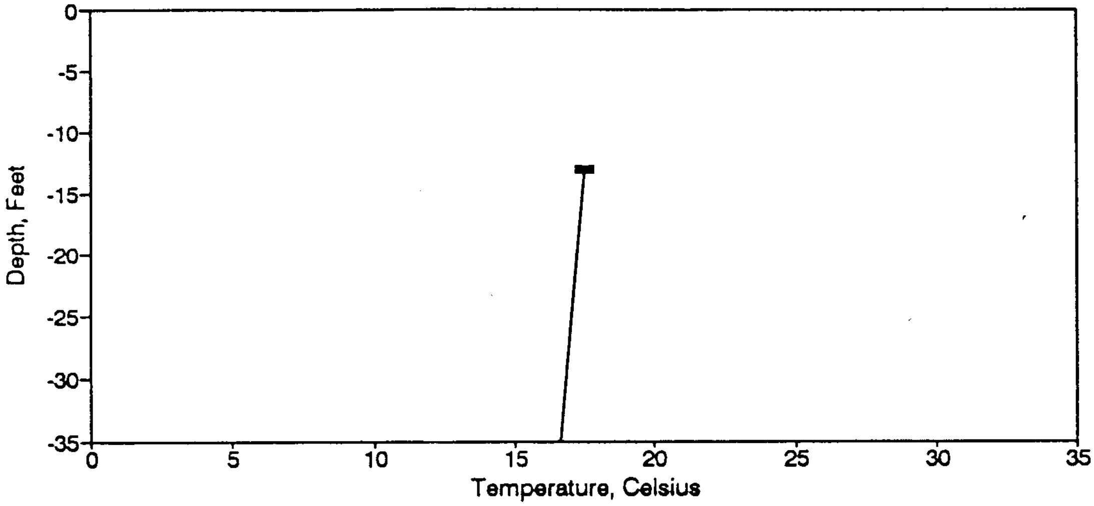

Figure BT103. Temperature Profile for the Waveland Site-May 24, 1990.

APPENDIX BC

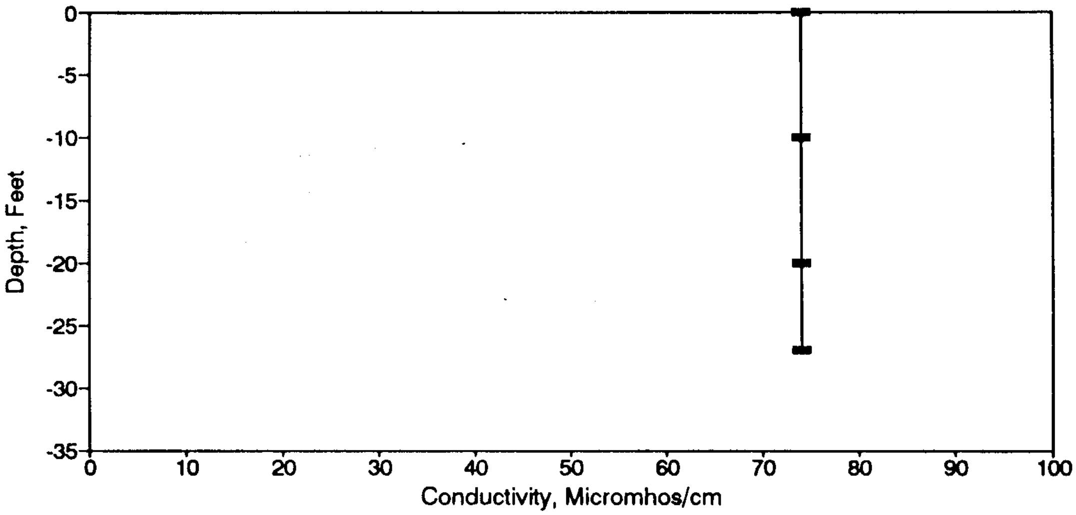

Figure BC1. Conductivity Profile for the Waveland Site-October 15, 1980.

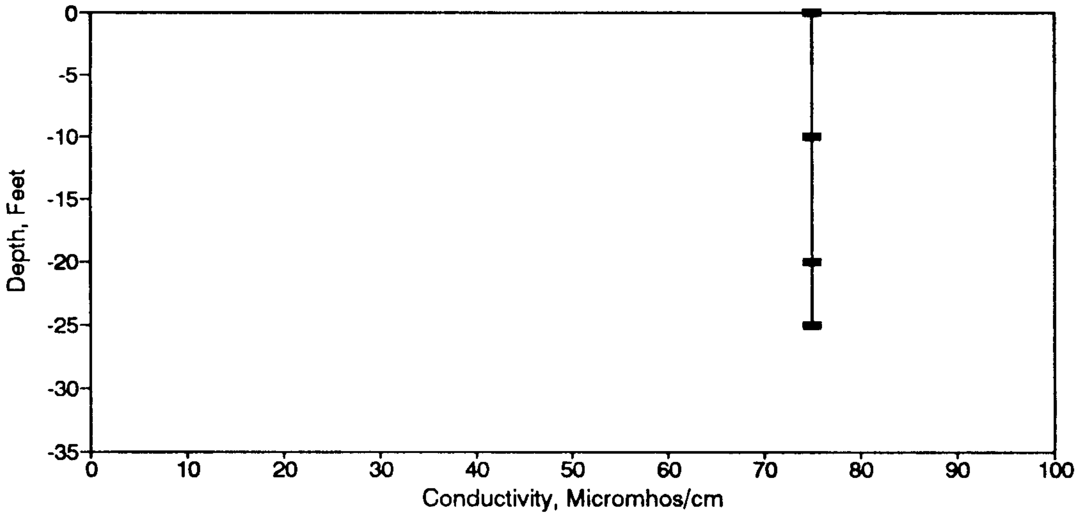

Figure BC2. Conductivity Profile for the Waveland Site-November 18, 1980

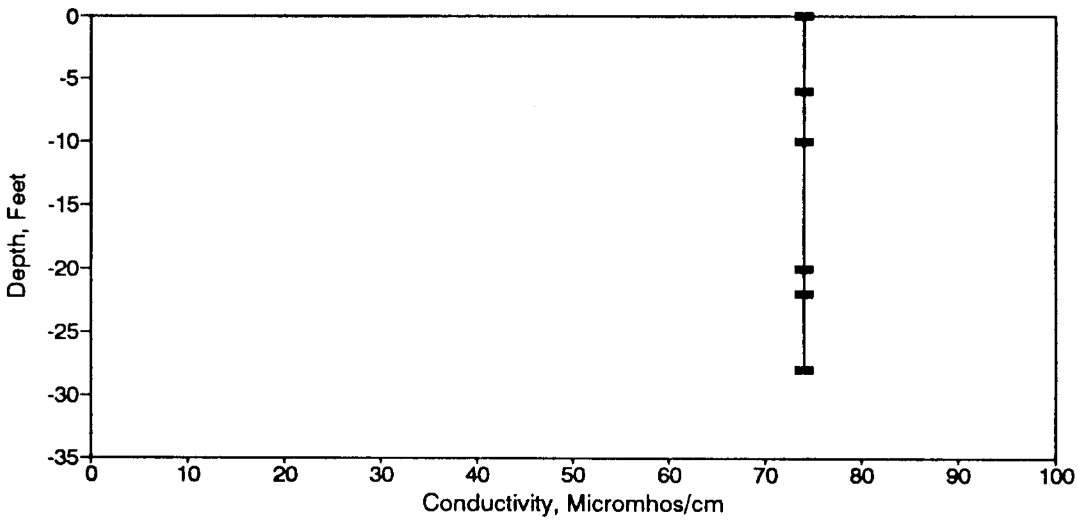

Figure BC3. Conductivity Profile for the Waveland Site-December 9, 1980.

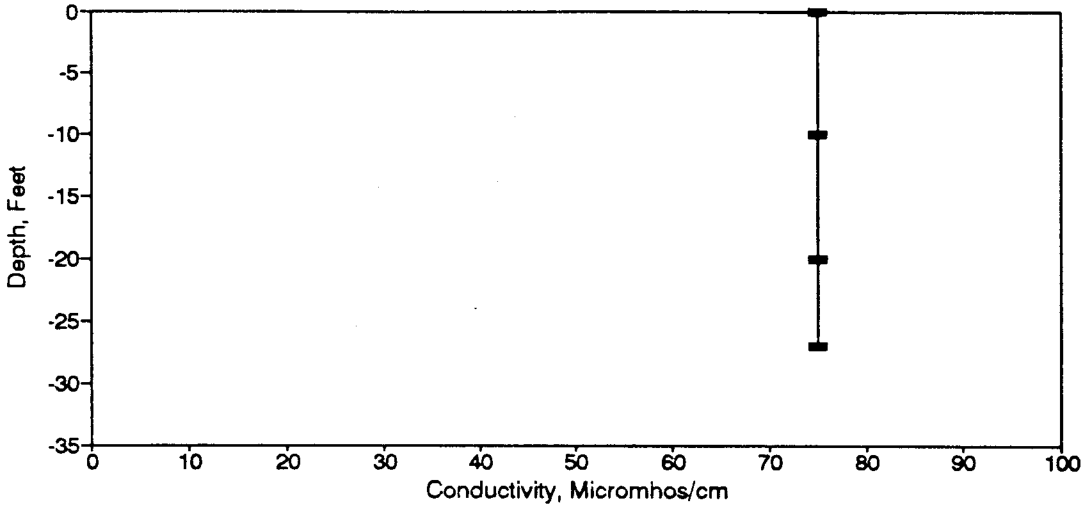

Figure BC4. Conductivity Profile for the Waveland Site-February 2, 1981.

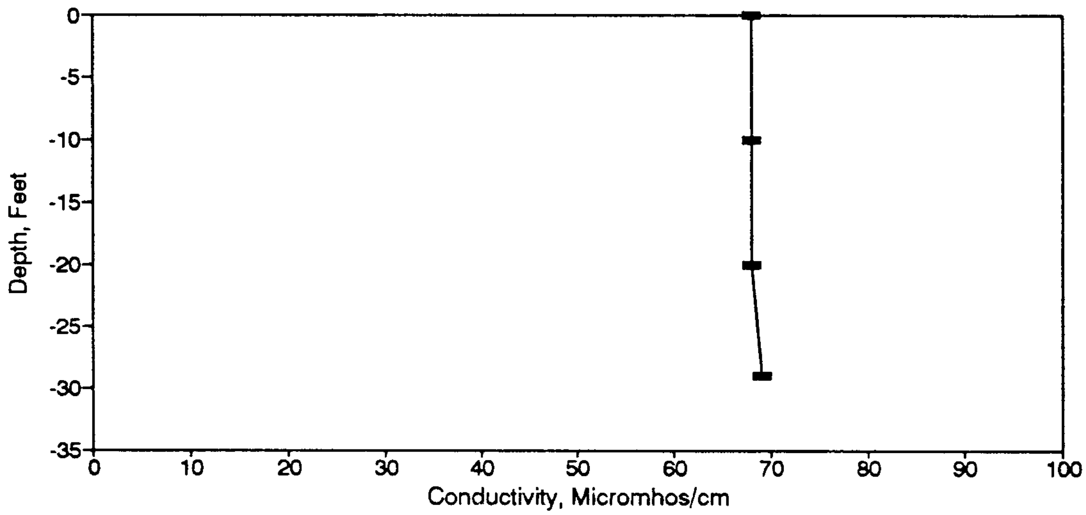

Figure BC5. Conductivity Profile for the Waveland Site-March 3, 1981.

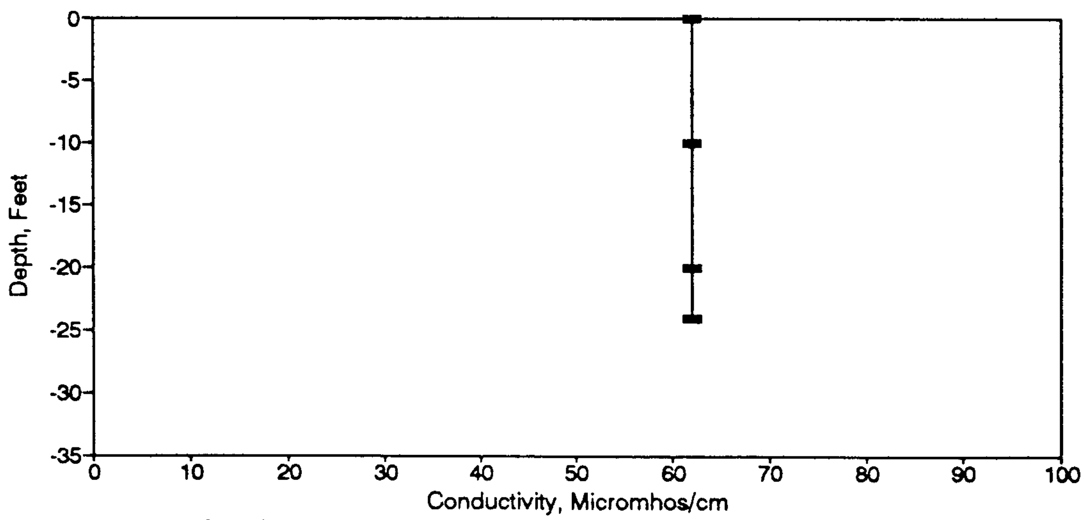

Figure BC6. Conductivity Profile for the Waveland Site-April 7, 1981.

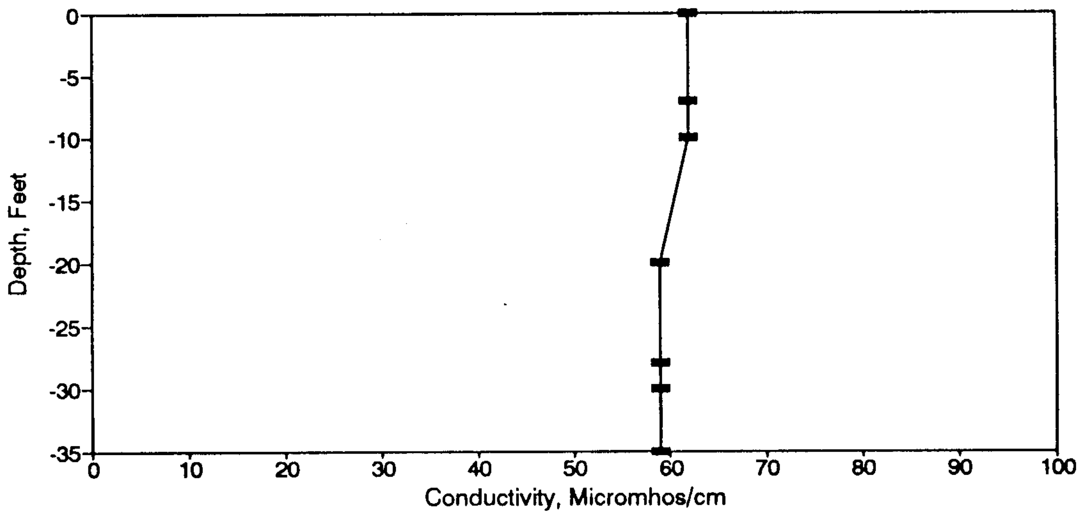

Figure BC7. Conductivity Profile for the Waveland Site-May 12, 1981.

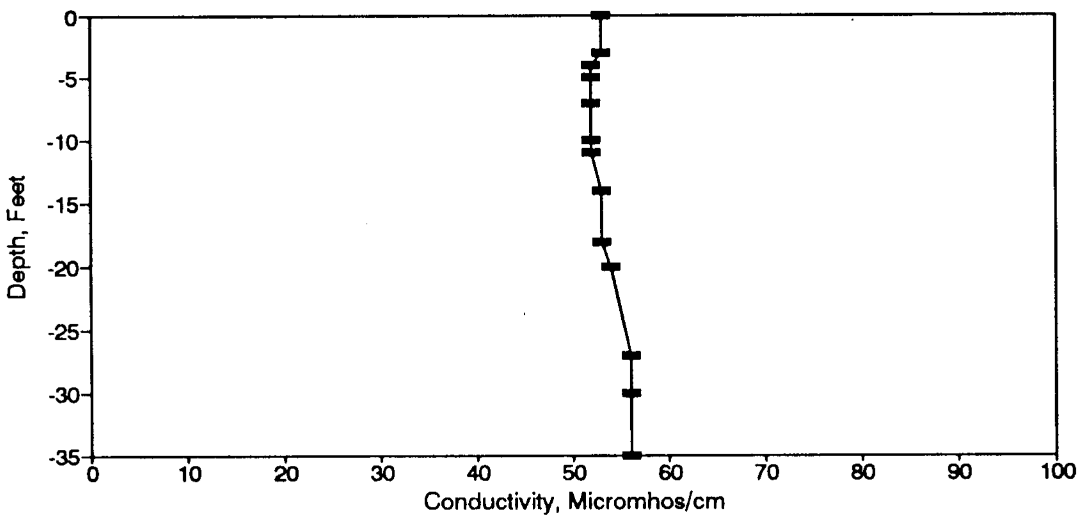

Figure BC8. Conductivity Profile for the Waveland Site-June 9, 1981.

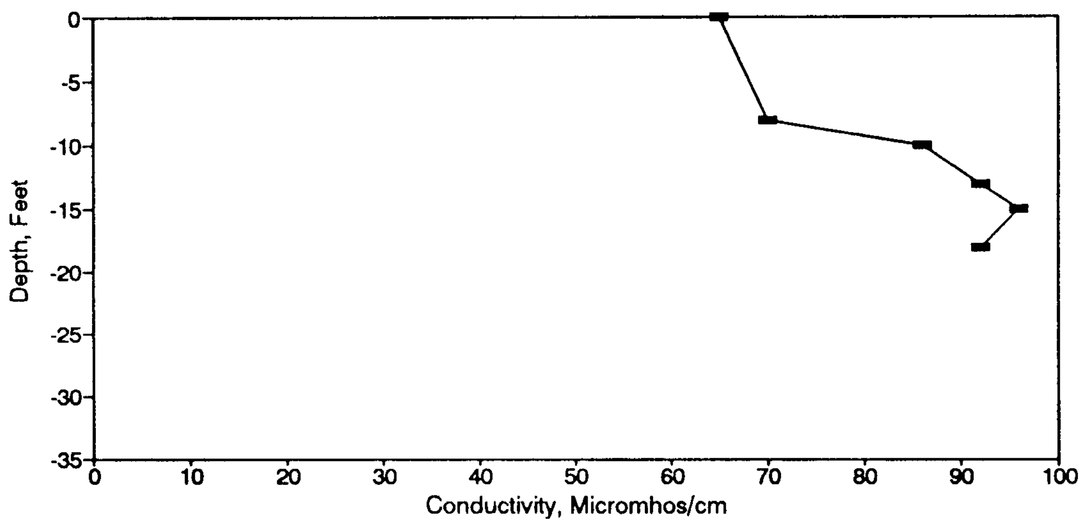

Figure BC9. Conductivity Profile for the Waveland Site-July 7, 1981.

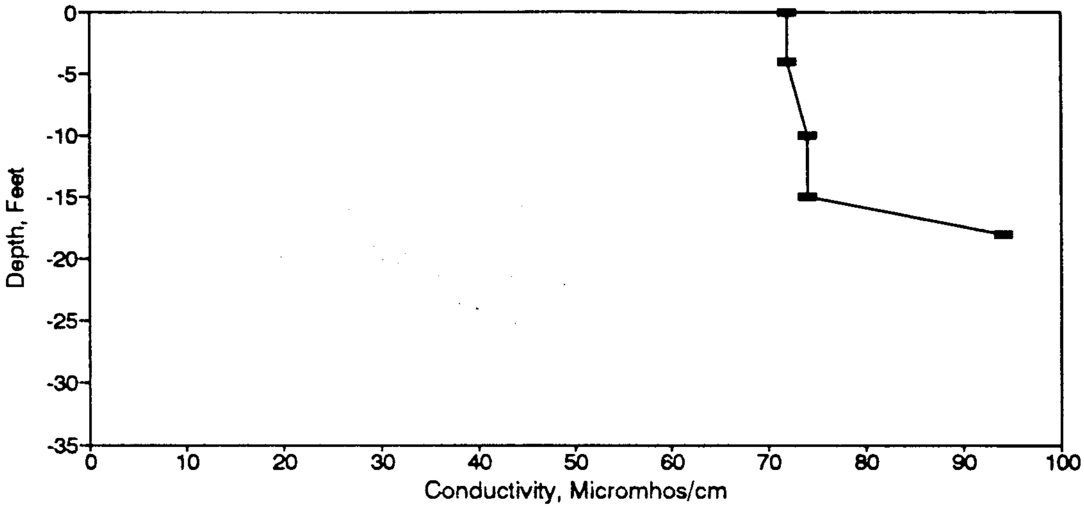

Figure BC10. Conductivity Profile for the Waveland Site-August 11, 1981.

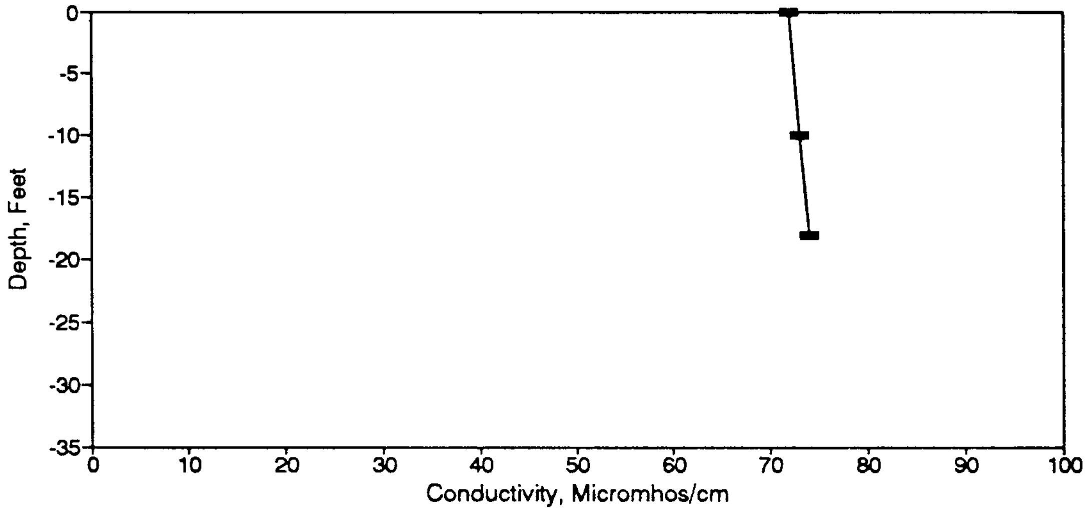

Figure BC11. Conductivity Profile for the Waveland Site-September 9, 1981.

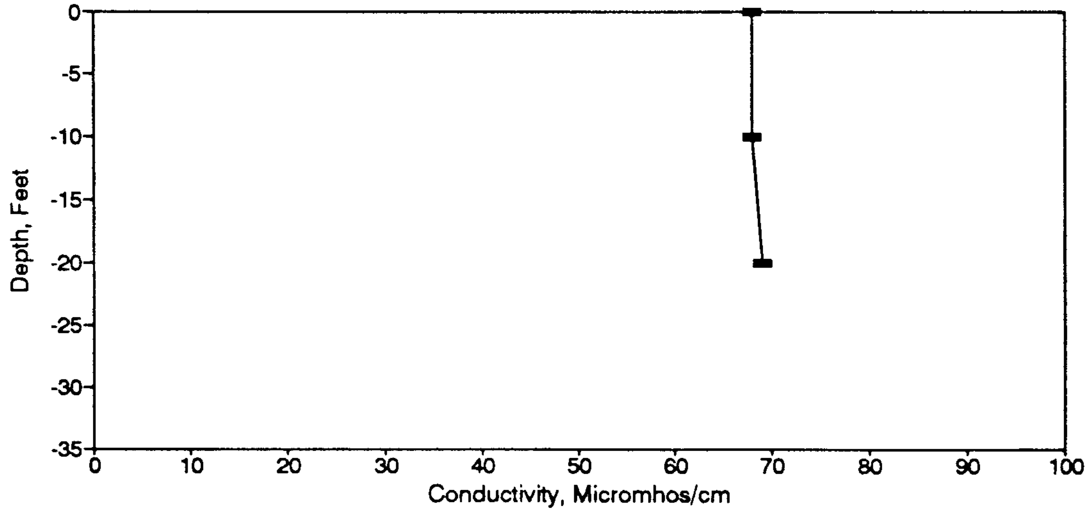

Figure BC12. Conductivity Profile for the Waveland Site-October 13, 1981.

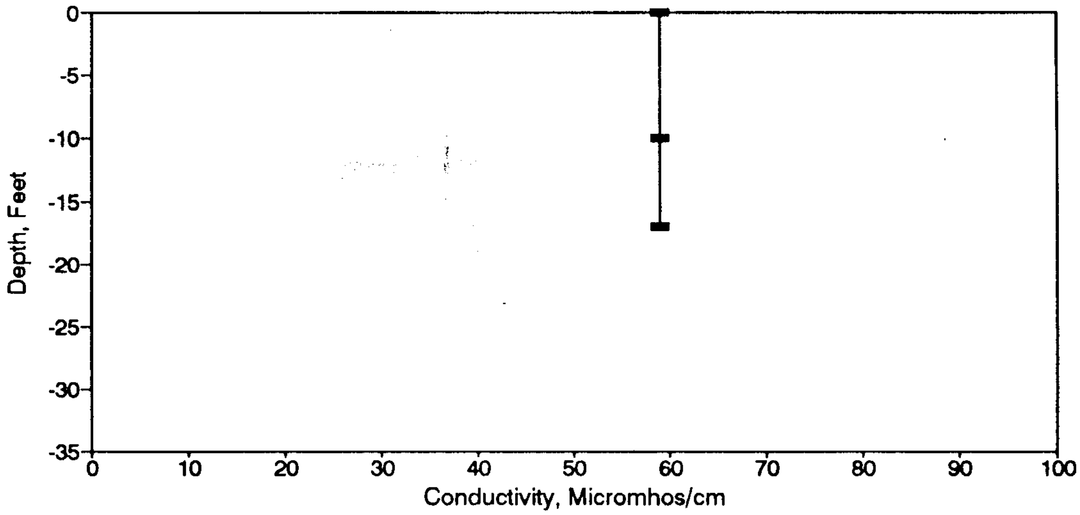

Figure BC13. Conductivity Profile for the Waveland Site-November 19,1981.

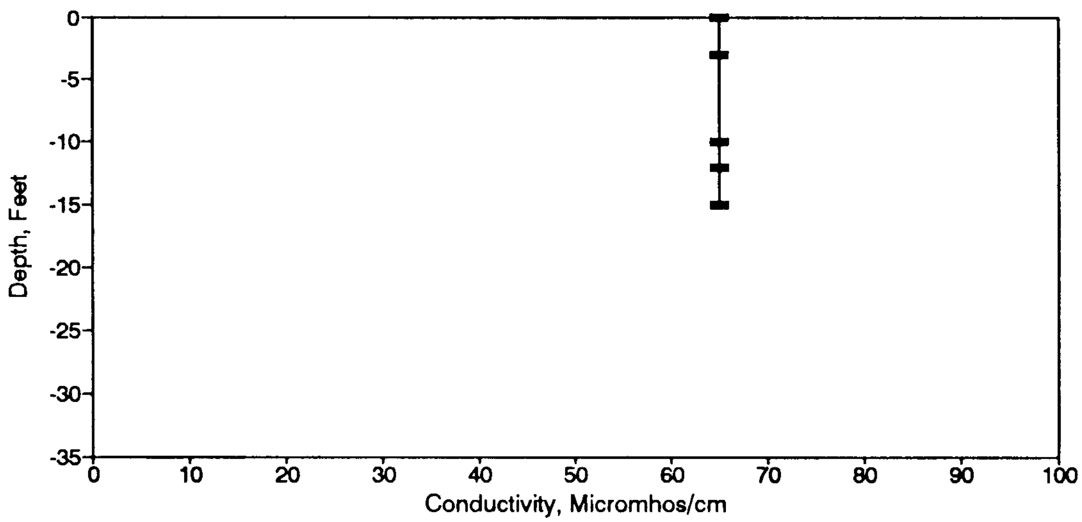

Figure BC14. Conductivity Profile for the Waveland Site-December 8, 1981.

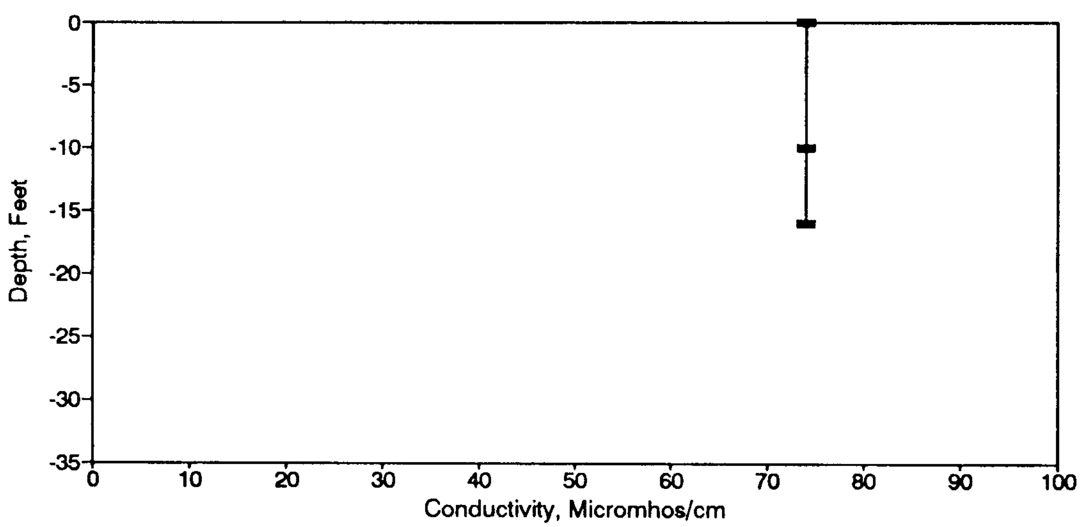

Figure BC15. Conductivity Profile for the Waveland Site-January 15, 1982.

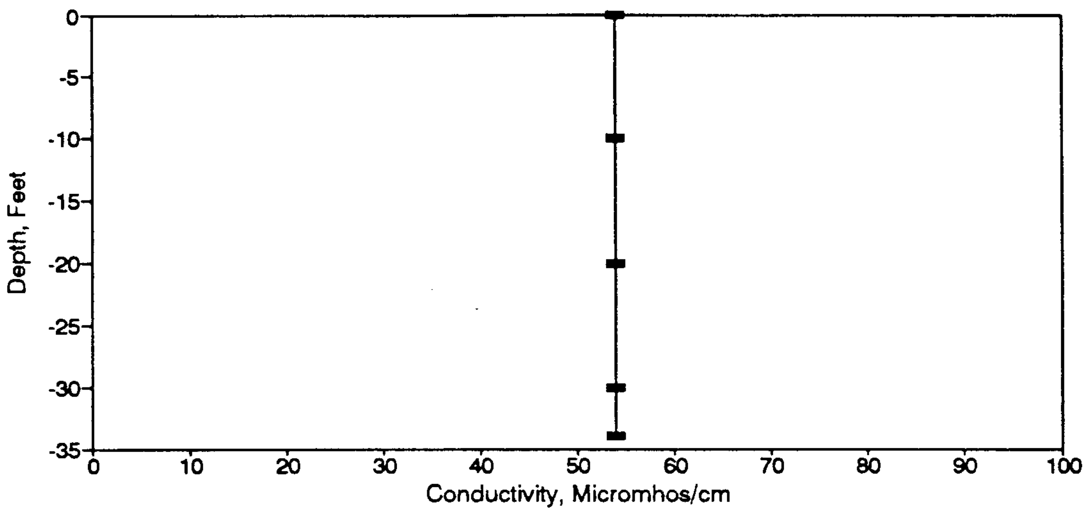

Figure BC16. Conductivity Profile for the Waveland Site-February 12, 1982.

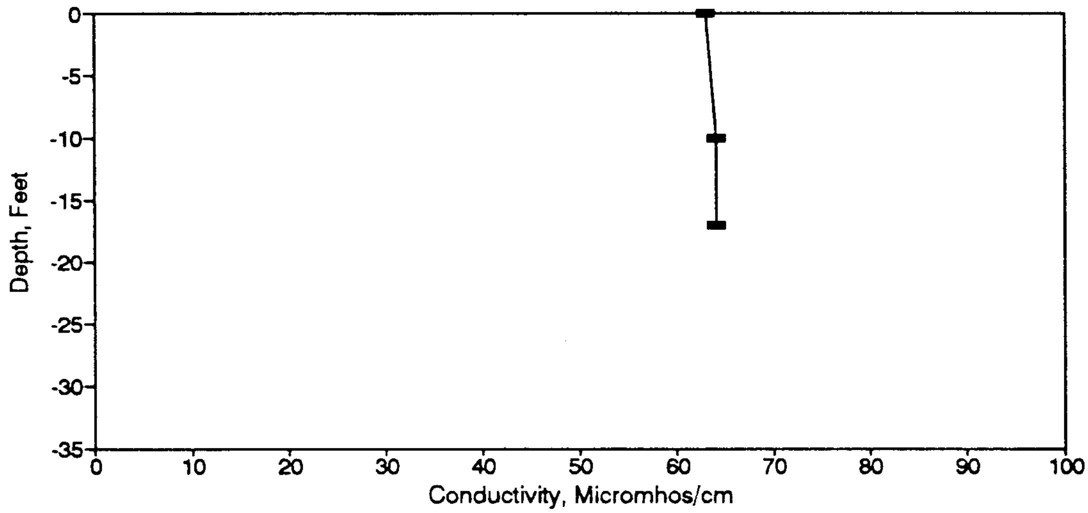

Figure BC17. Conductivity Profile for the Waveland Site-March 15, 1982.

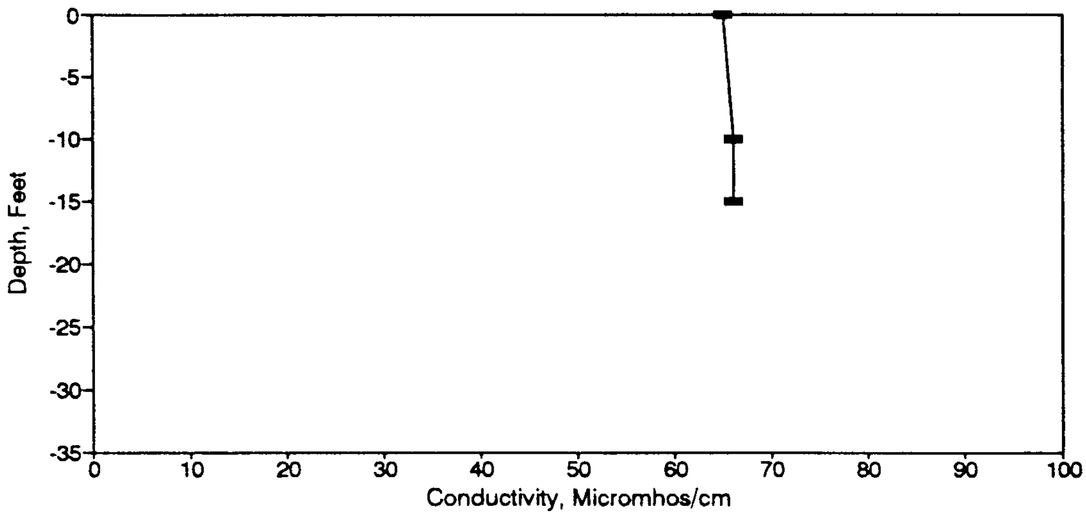

Figure BC18. Conductivity Profile for the Waveland Site-April 2, 1982.

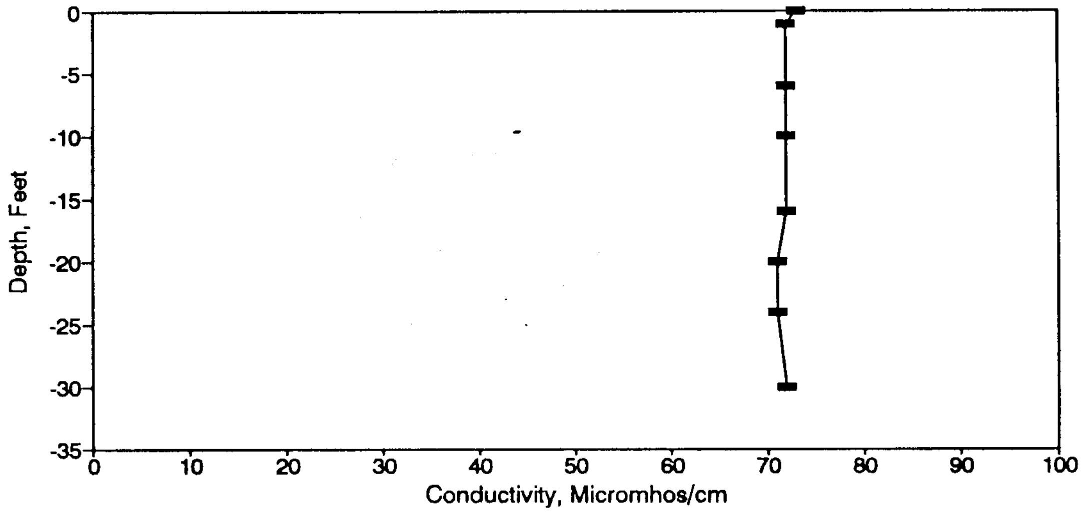

Figure BC19. Conductivity Profile for the Waveland Site-May 17, 1982.

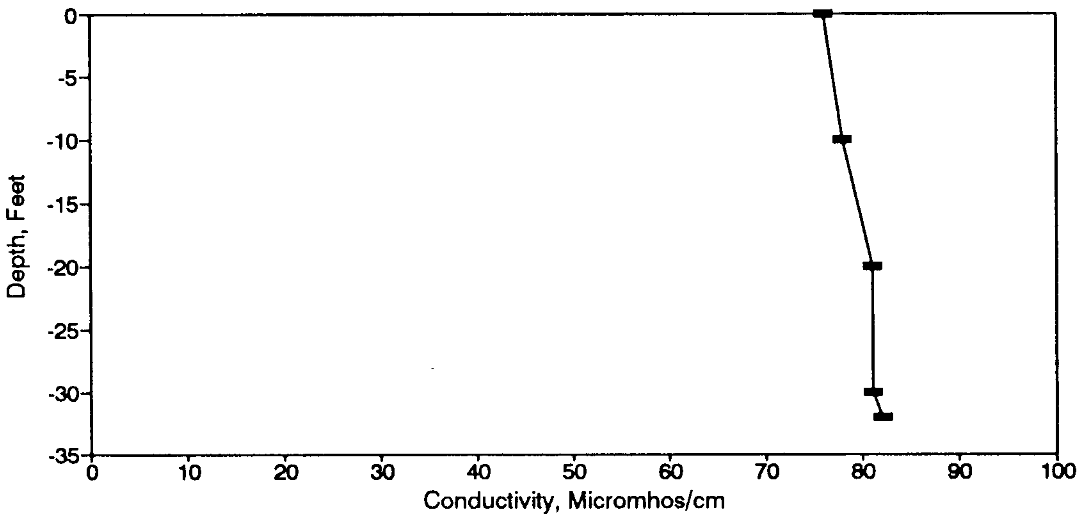

Figure BC20. Conductivity Profile for the Waveland Site-June 18, 1982.

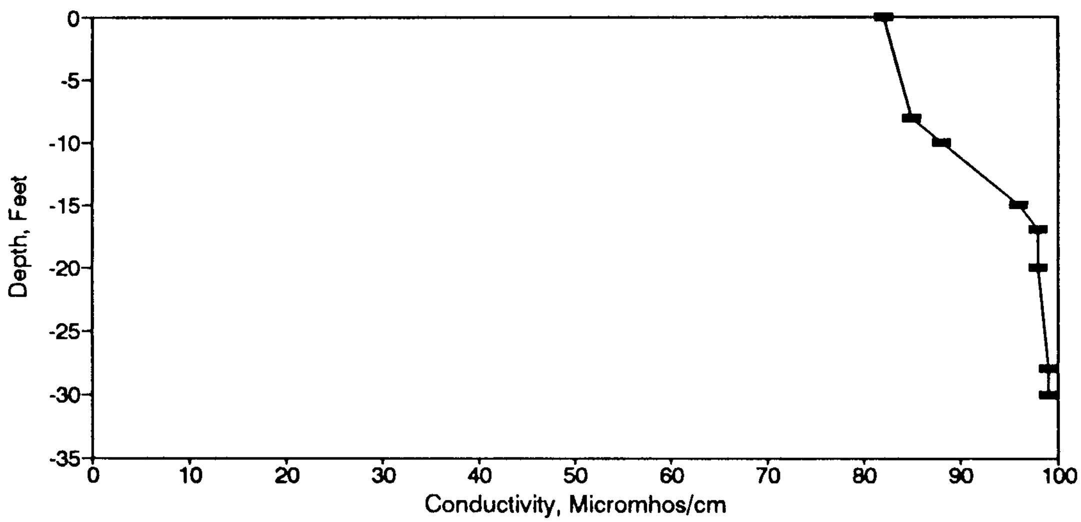

Figure BC21. Conductivity Profile for the Waveland Site-July 12, 1982.

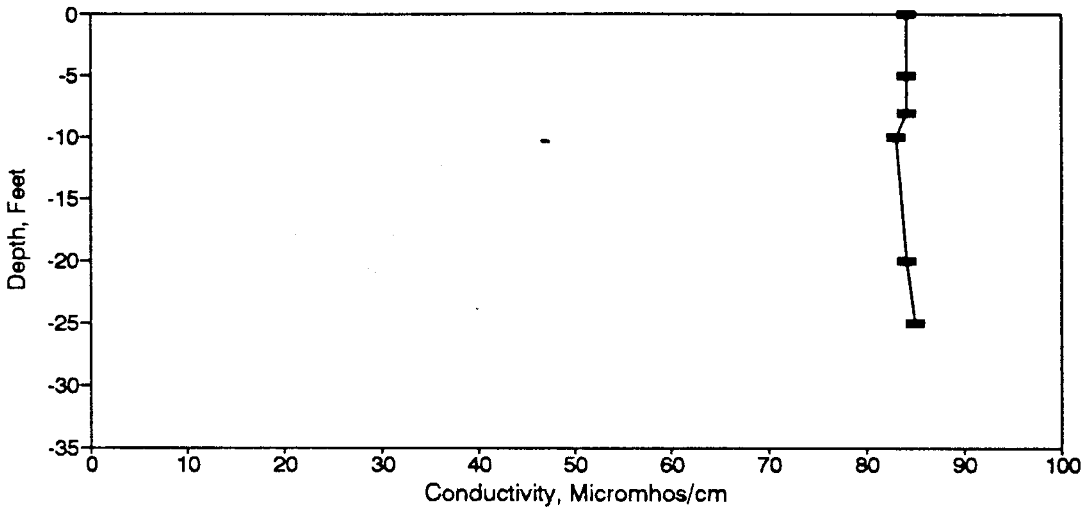

Figure BC22. Conductivity Profile for the Waveland Site-August 16, 1982.

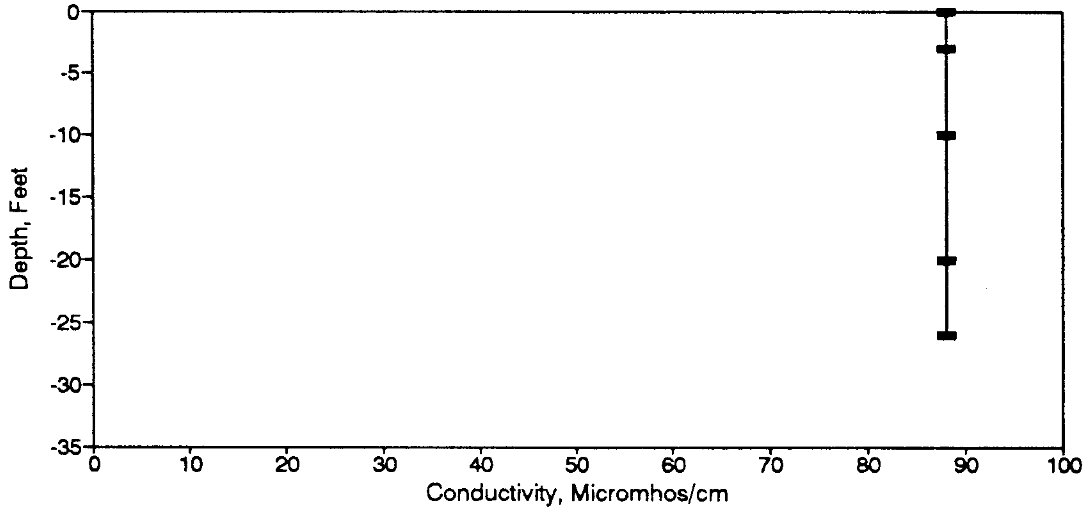

Figure BC23. Conductivity Profile for the Waveland Site-September 29, 1982.

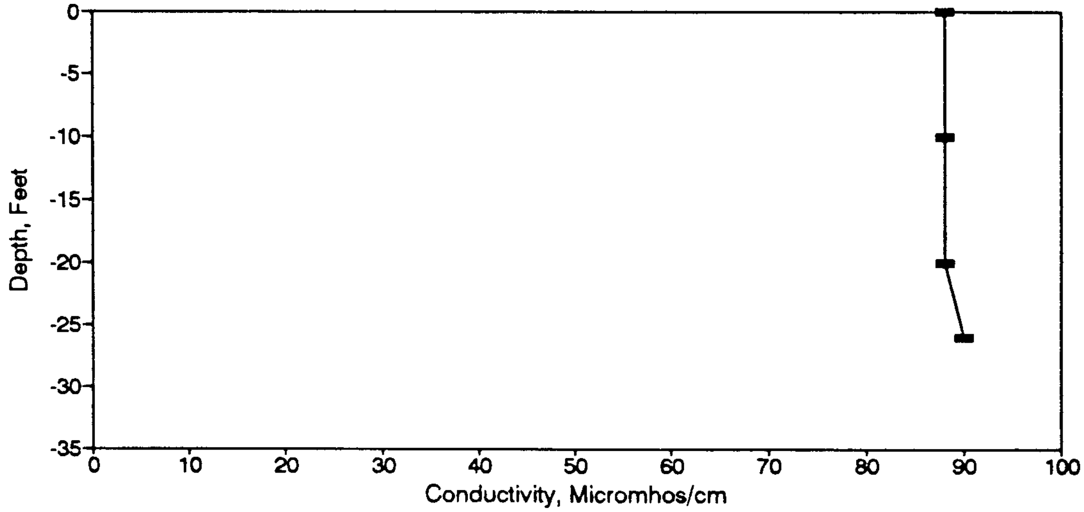

Figure BC24. Conductivity Profile for the Waveland Site-October 15, 1982.

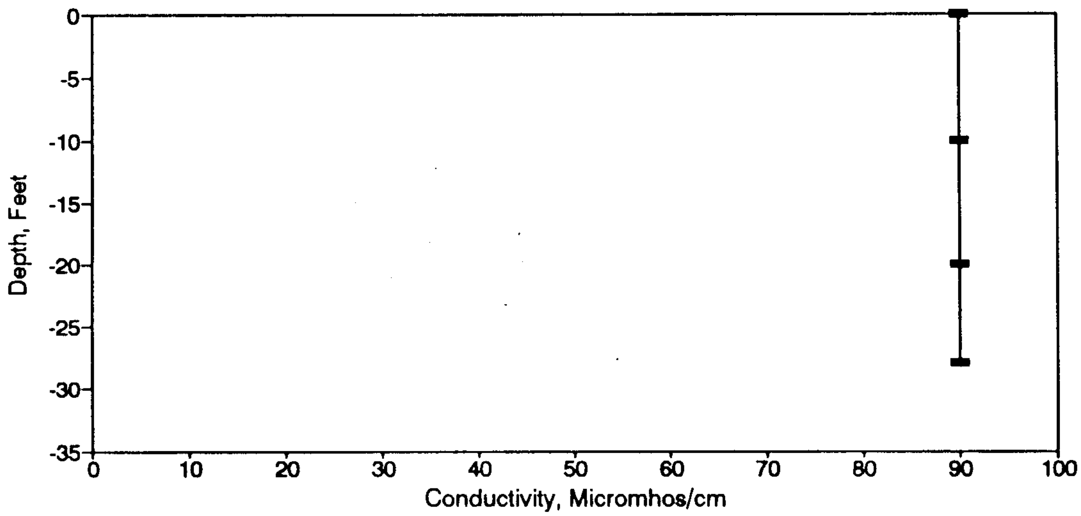

Figure BC25. Conductivity Profile for the Waveland Site-November 16, 1982.

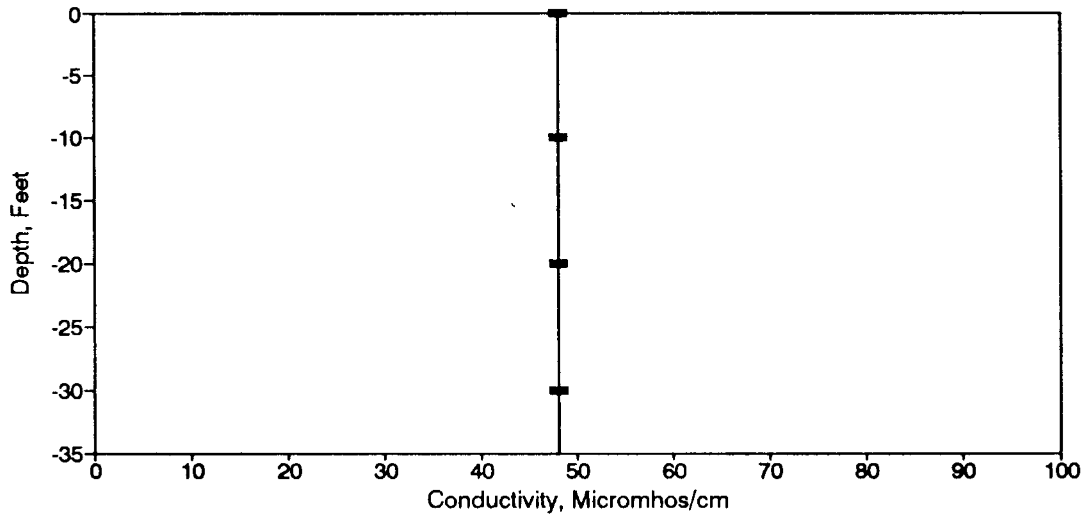

Figure BC26. Conductivity Profile for the Waveland Site-December 20, 1982.

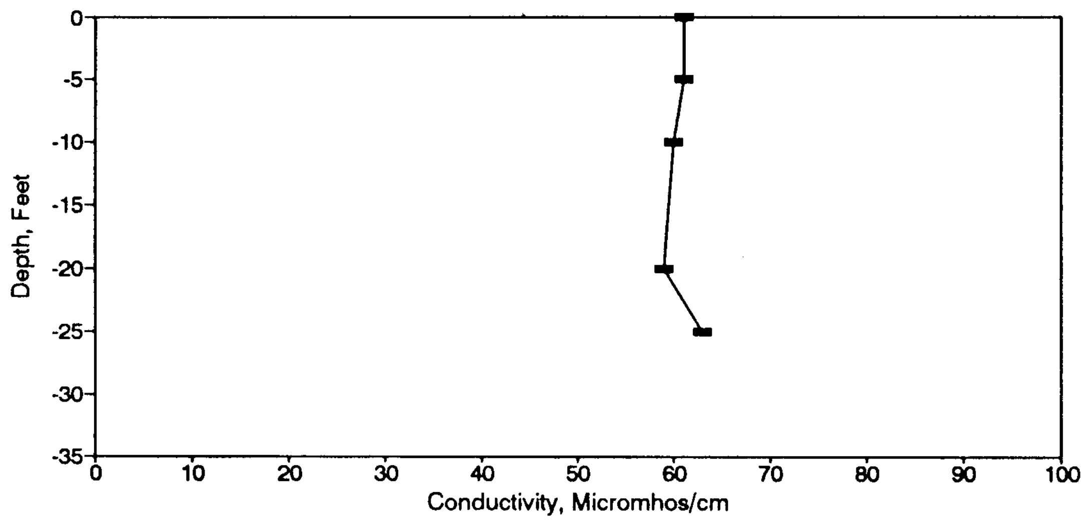

Figure BC27. Conductivity Profile for the Waveland Site-January 26, 1983.

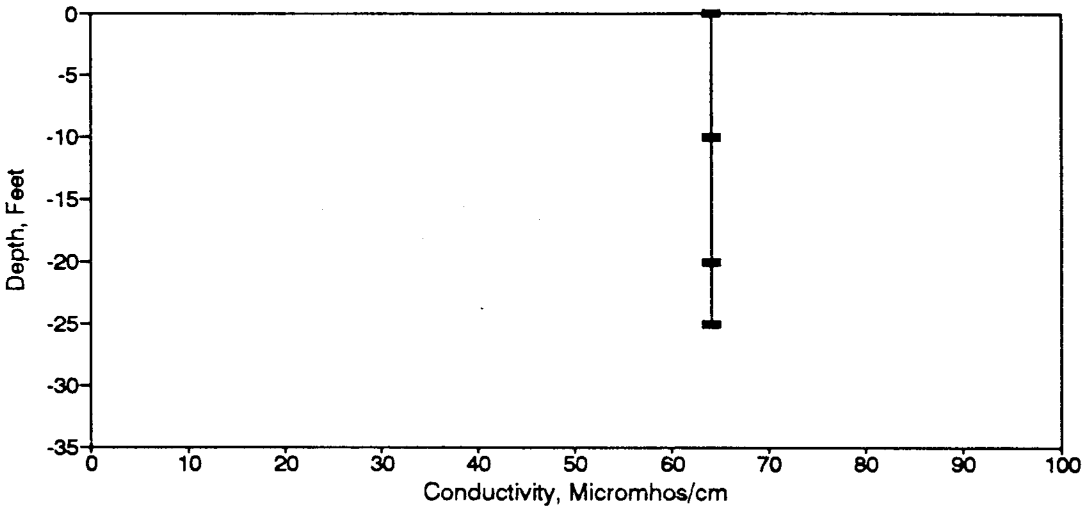

Figure BC28. Conductivity Profile for the Waveland Site-February 18, 1983.

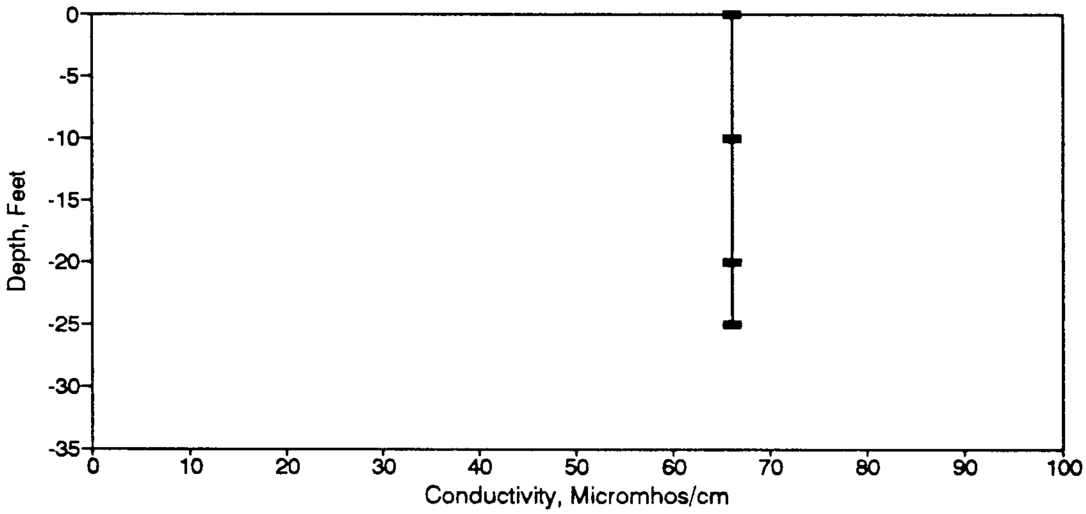

Figure BC29. Conductivity Profile for the Waveland Site-March 25, 1983.

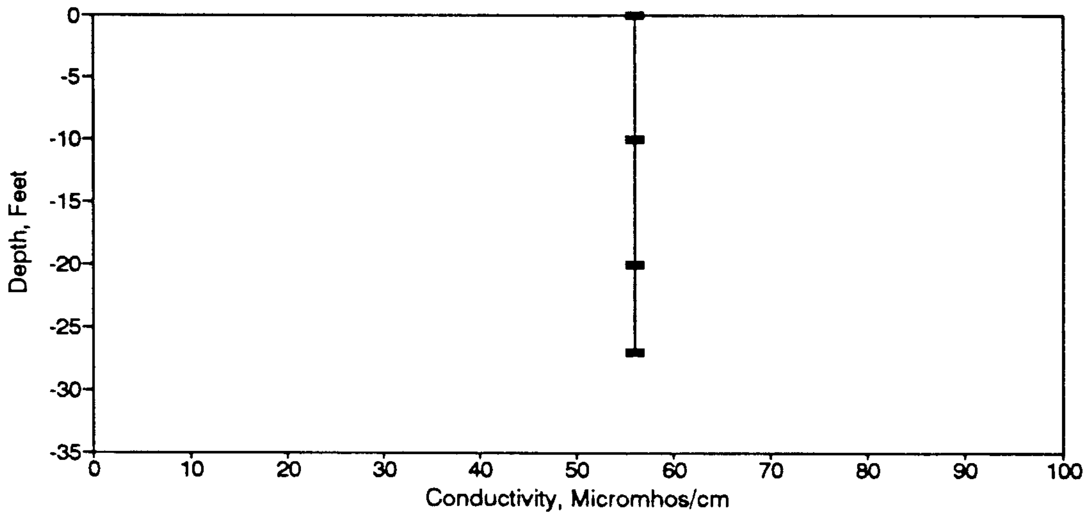

Figure BC30. Conductivity Profile for the Waveland Site-April 18, 1983.

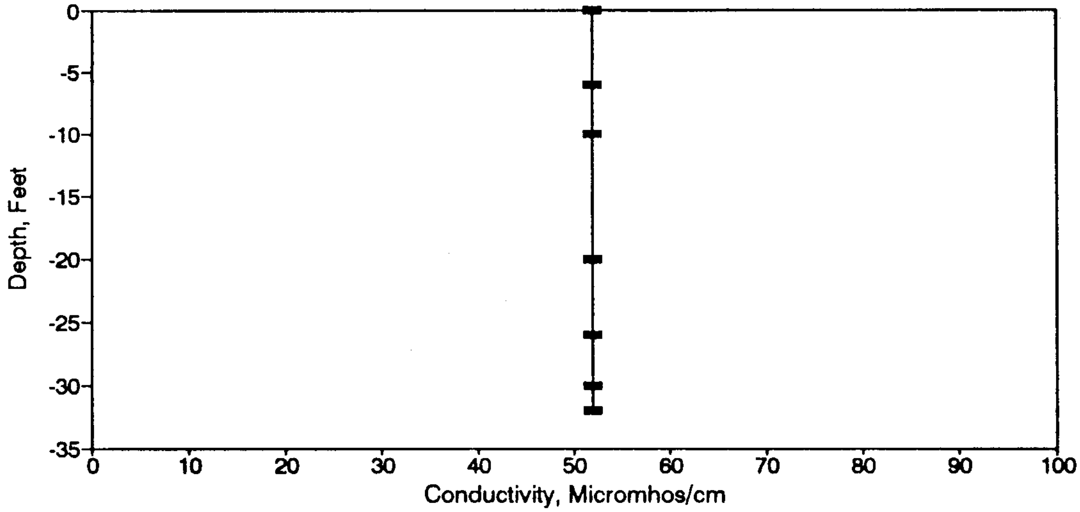

Figure BC31. Conductivity Profile for the Waveland Site-May 16, 1983.

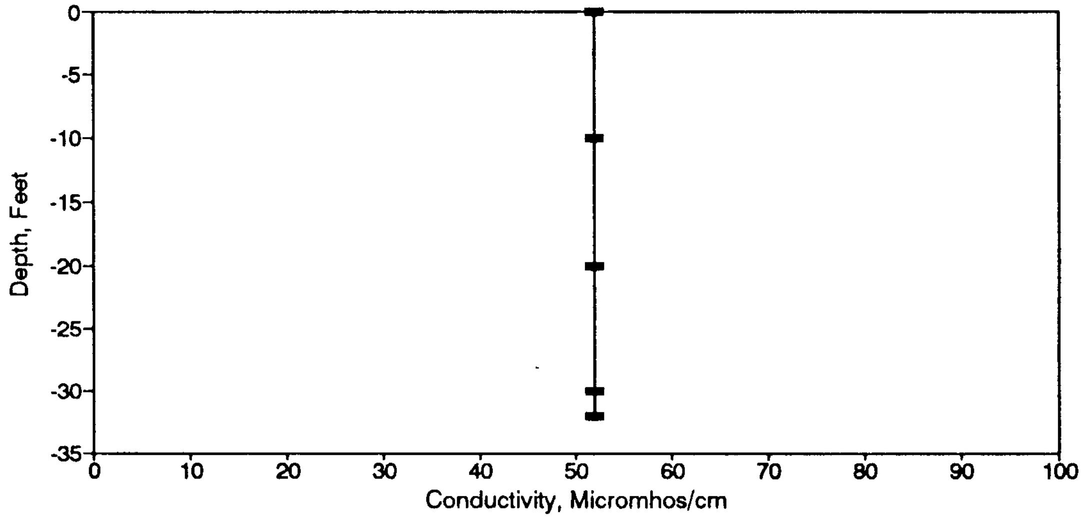

Figure BC32. Conductivity Profile for the Waveland Site-June 9, 1983.

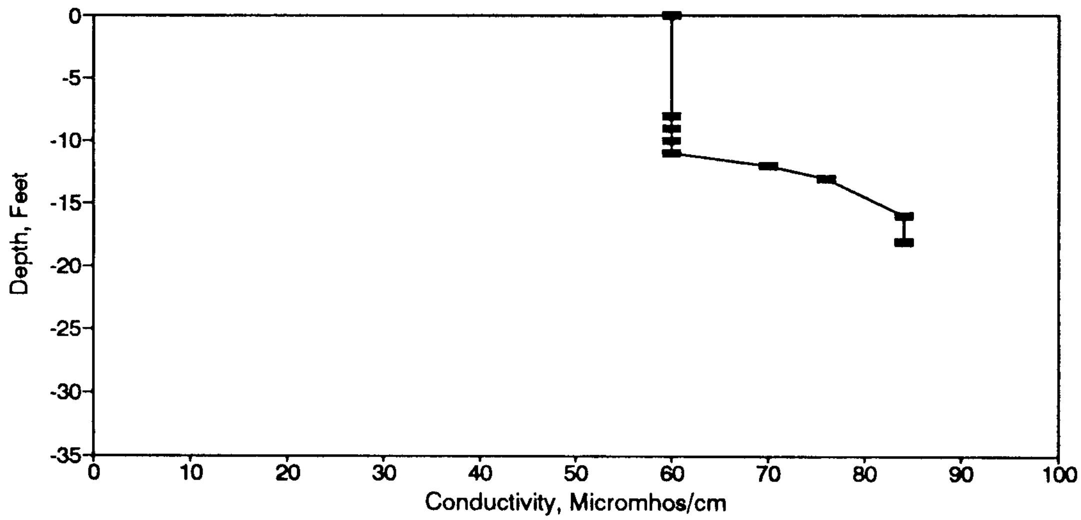

Figure BC33. Conductivity Profile for the Waveland Site-July 22, 1983.

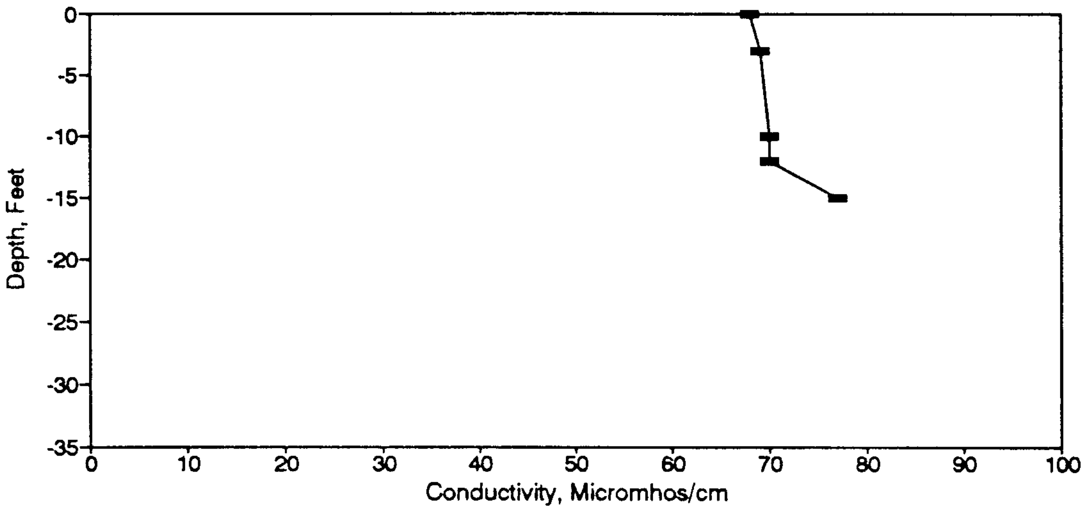

Figure BC34. Conductivity Profile for the Waveland Site-August 15, 1983.

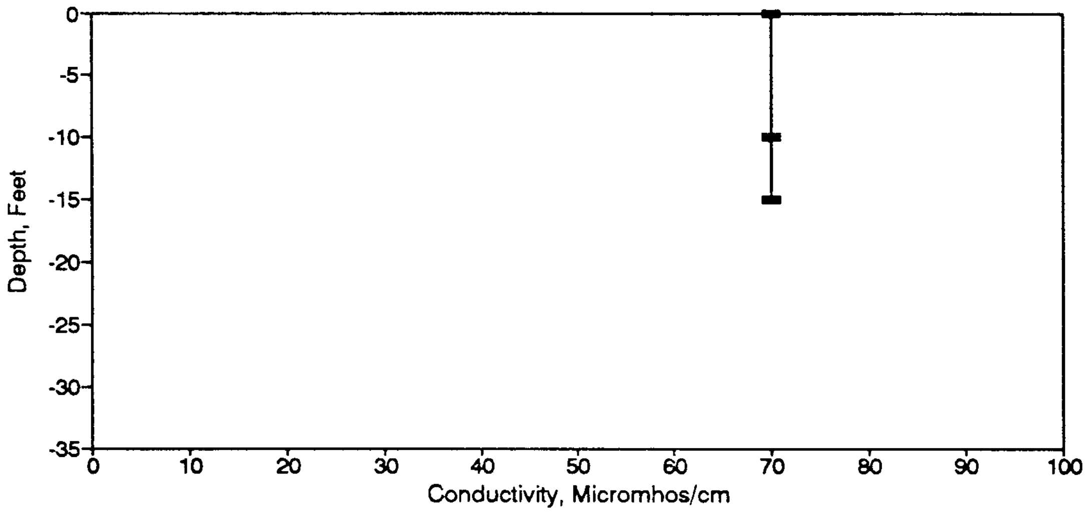

Figure BC35. Conductivity Profile for the Waveland Site-September 14, 1983.

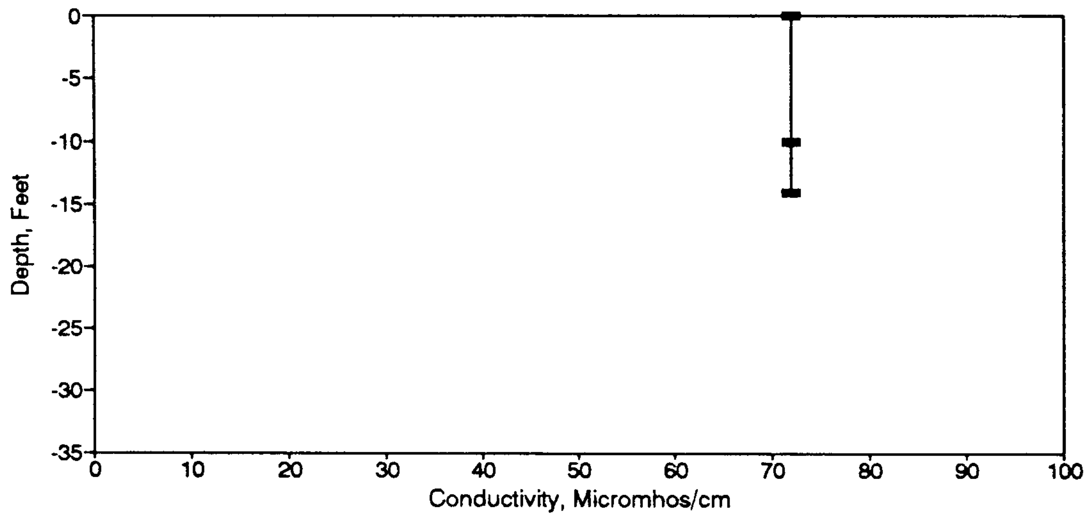

Figure BC36. Conductivity Profile for the Waveland Site-October 14, 1983.

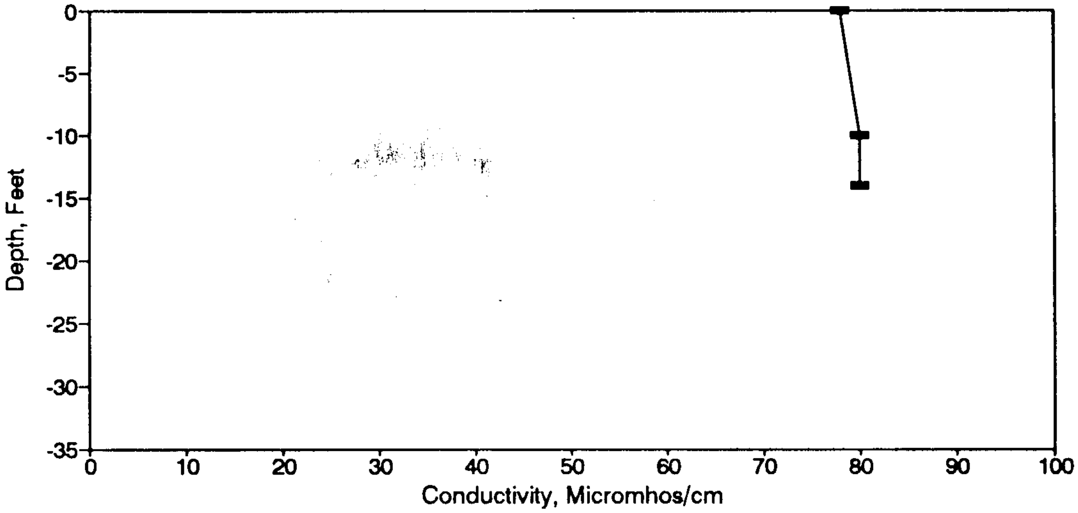

Figure BC37. Conductivity Profile for the Waveland Site-November 1, 1983.

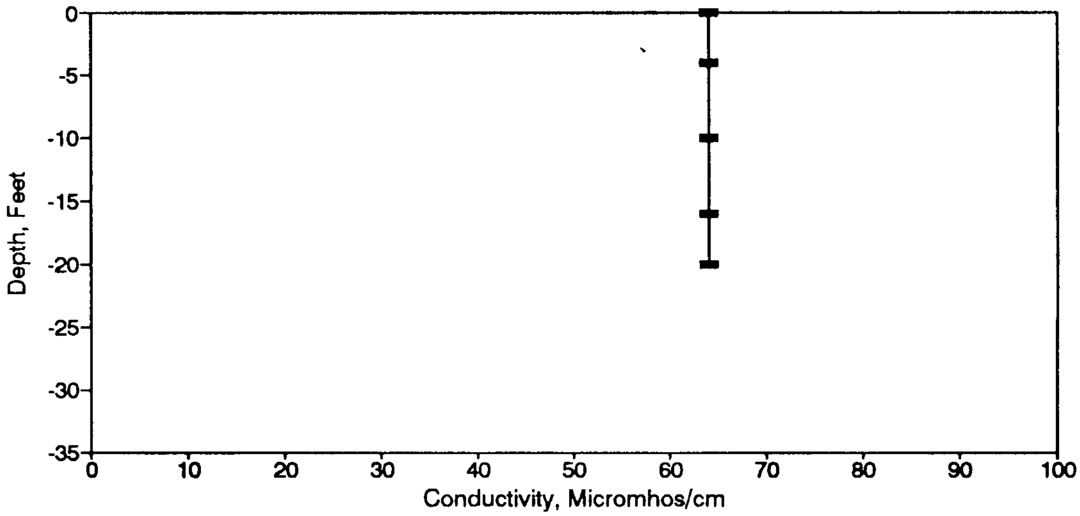

Figure BC38. Conductivity Profile for the Waveland Site-December 5, 1983.

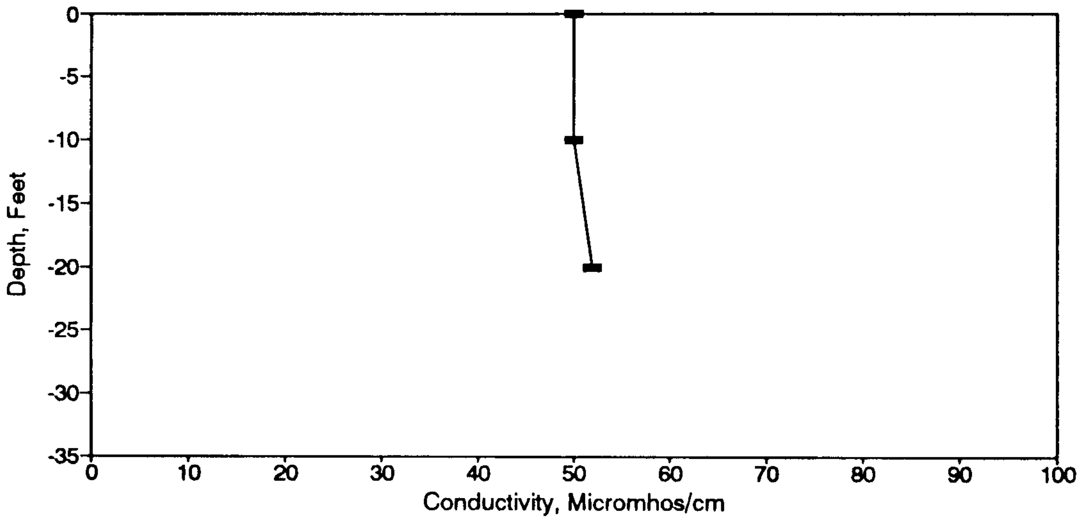

Figure BC39. Conductivity Profile for the Waveland Site-January 12, 1984.

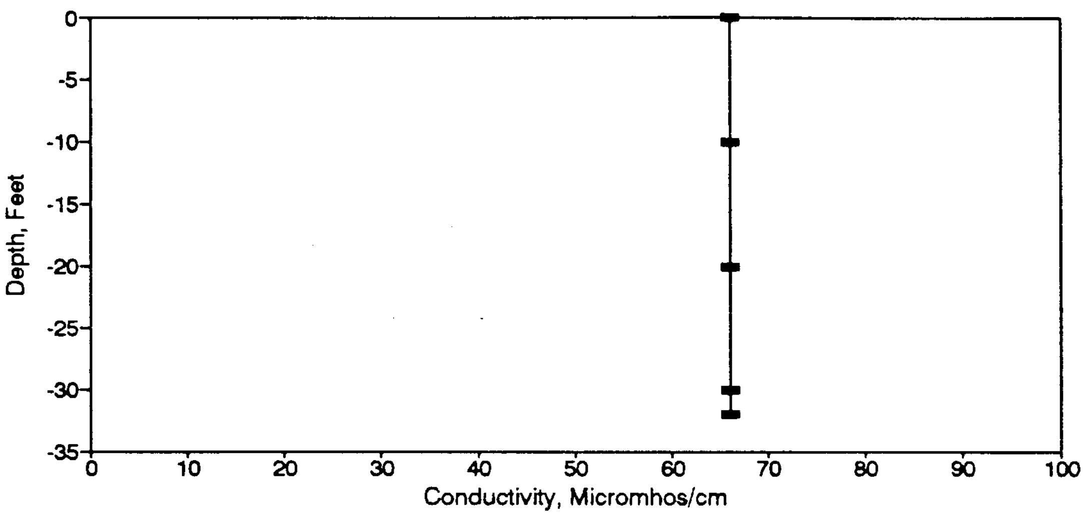

Figure BC40. Conductivity Profile for the Waveland Site-February 6, 1984.

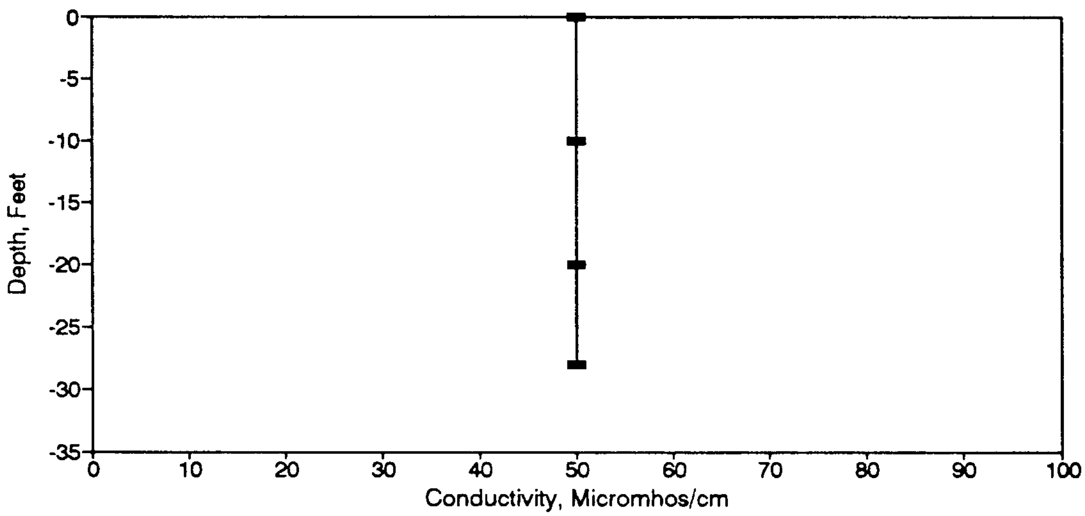

Figure BC41. Conductivity Profile for the Waveland Site-March 19, 1984.

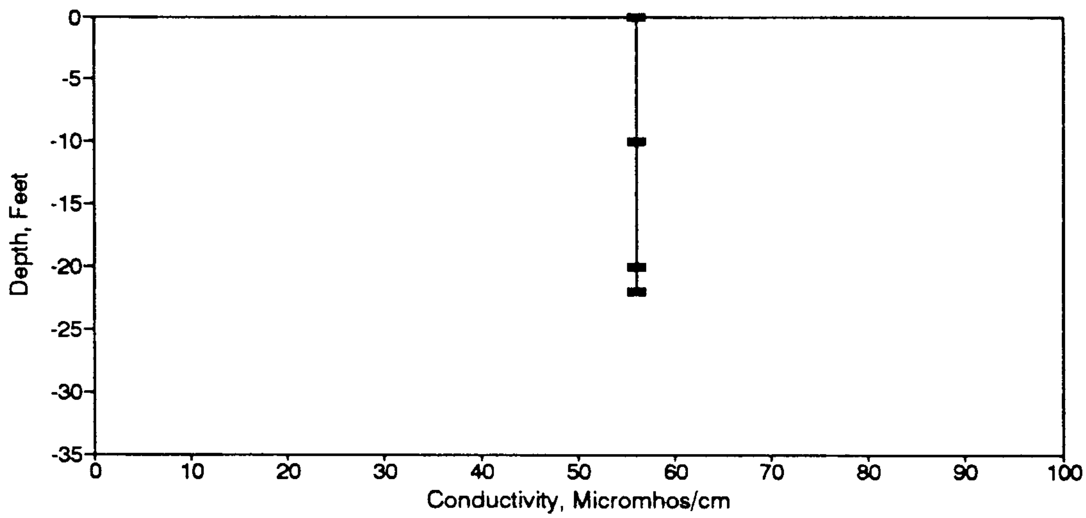

Figure BC42. Conductivity Profile for the Waveland Site-April 9, 1984.

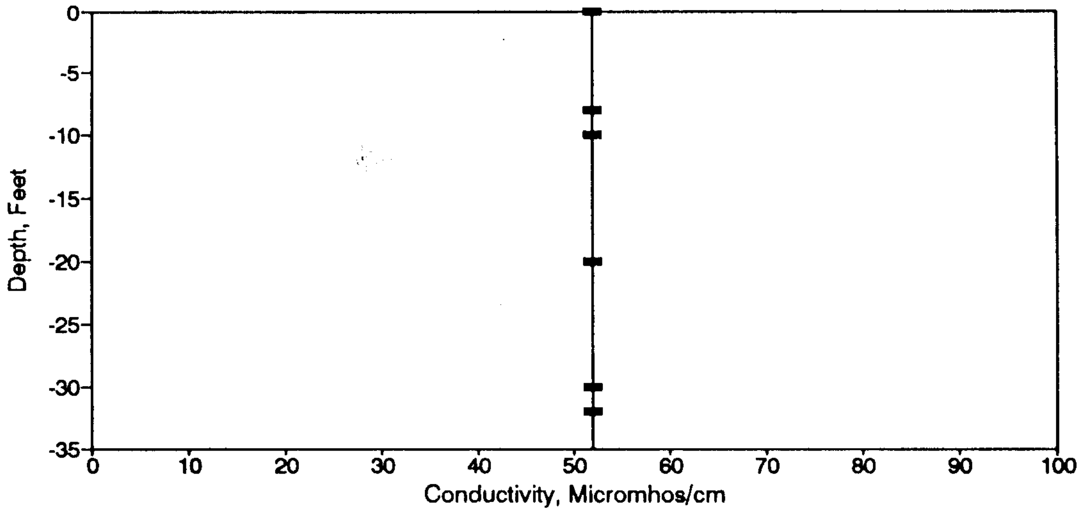

Figure BC43. Conductivity Profile for the Waveland Site-May 8, 1984.

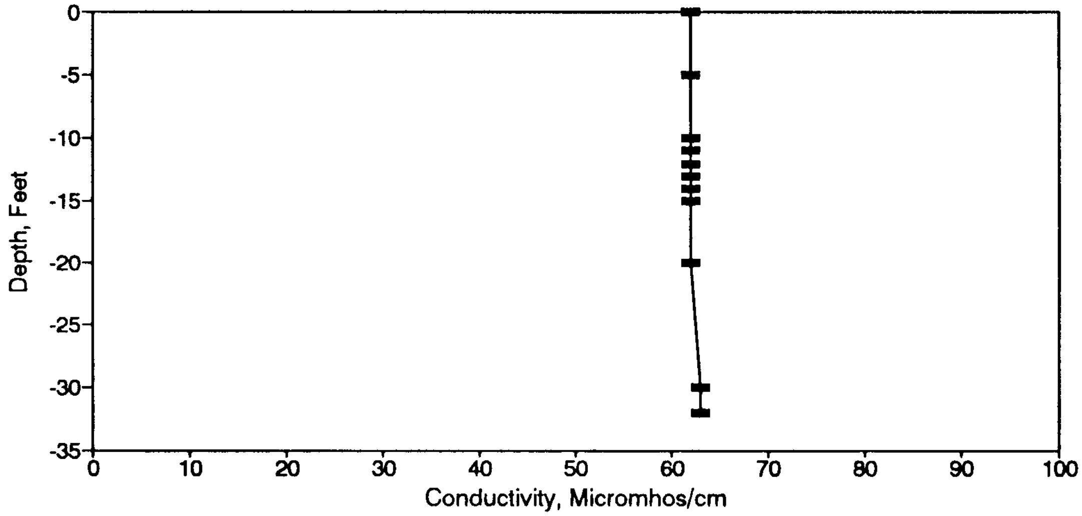

Figure BC44. Conductivity Profile for the Waveland Site-June 18, 1984.

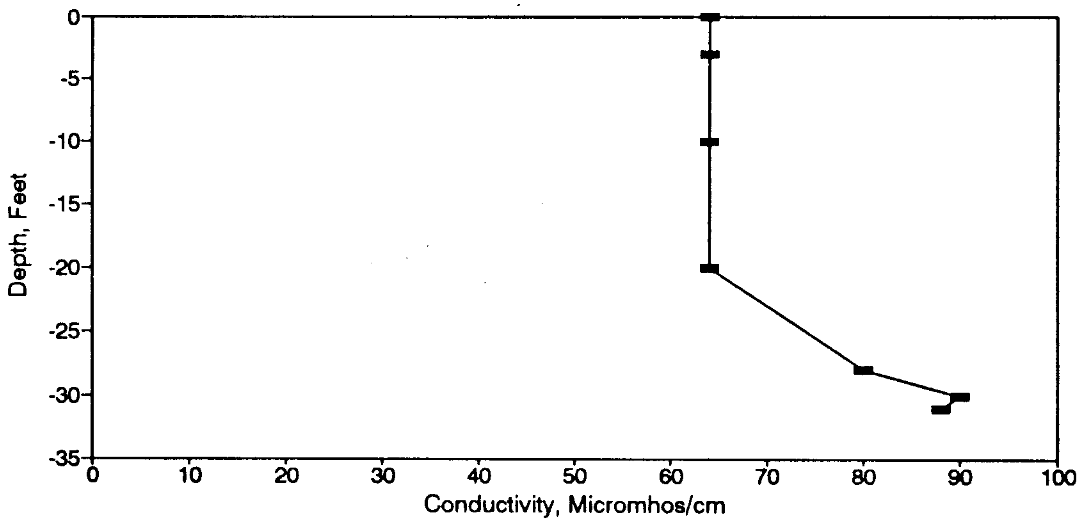

Figure BC45. Conductivity Profile for the Waveland Site-July 23, 1984.

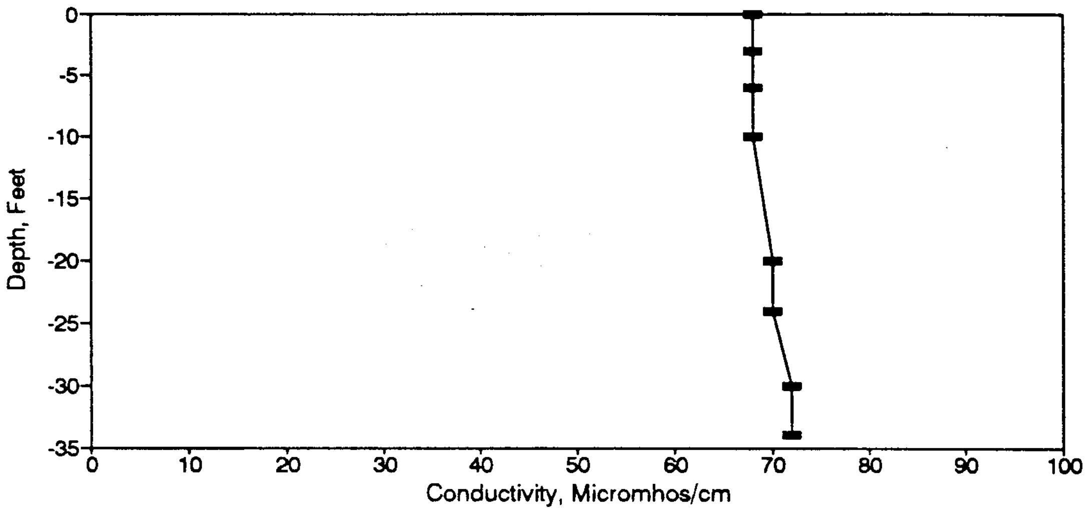

Figure BC46. Conductivity Profile for the Waveland Site-August 27, 1984.

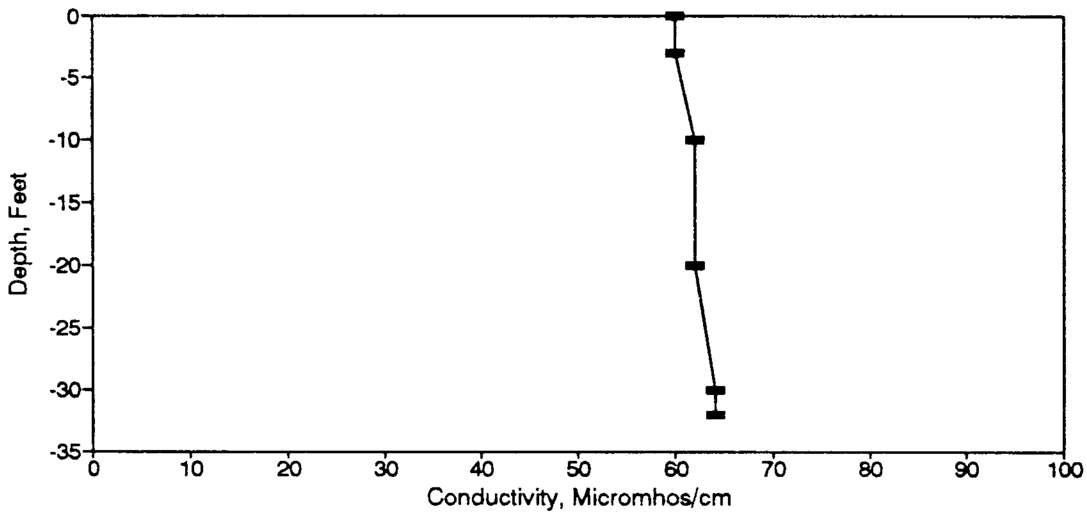

Figure BC47. Conductivity Profile for the Waveland Site-September 24, 1984.

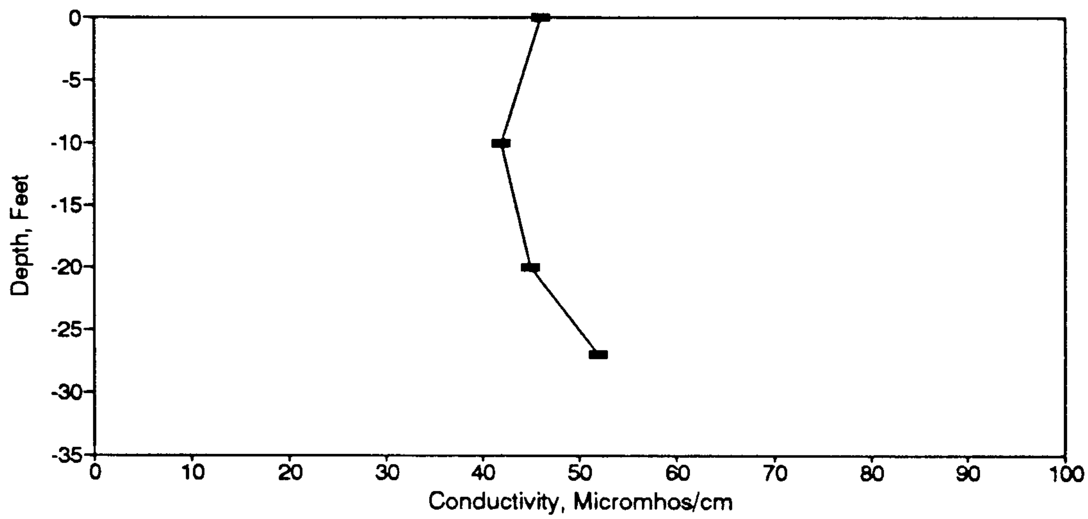

Figure BC48. Conductivity Profile for the Waveland Site-October 11, 1984.

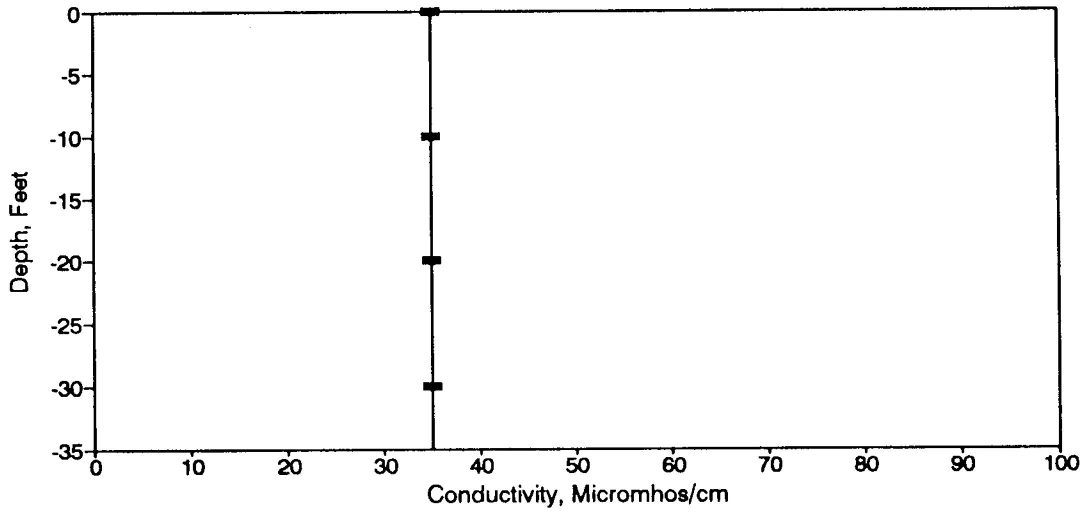

Figure BC49. Conductivity Profile for the Waveland Site-November 21, 1984.

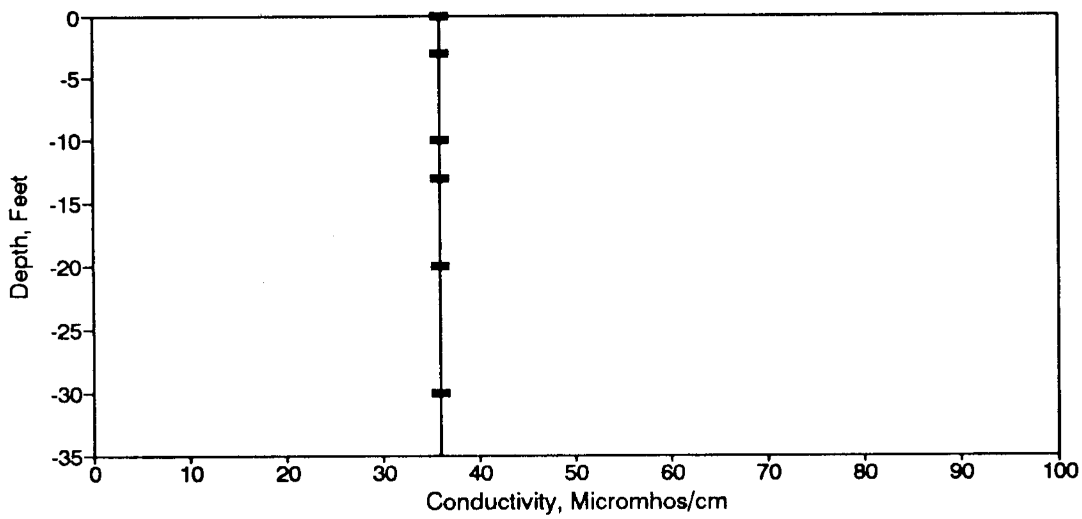

Figure BC50. Conductivity Profile for the Waveland Site-December 20, 1984.

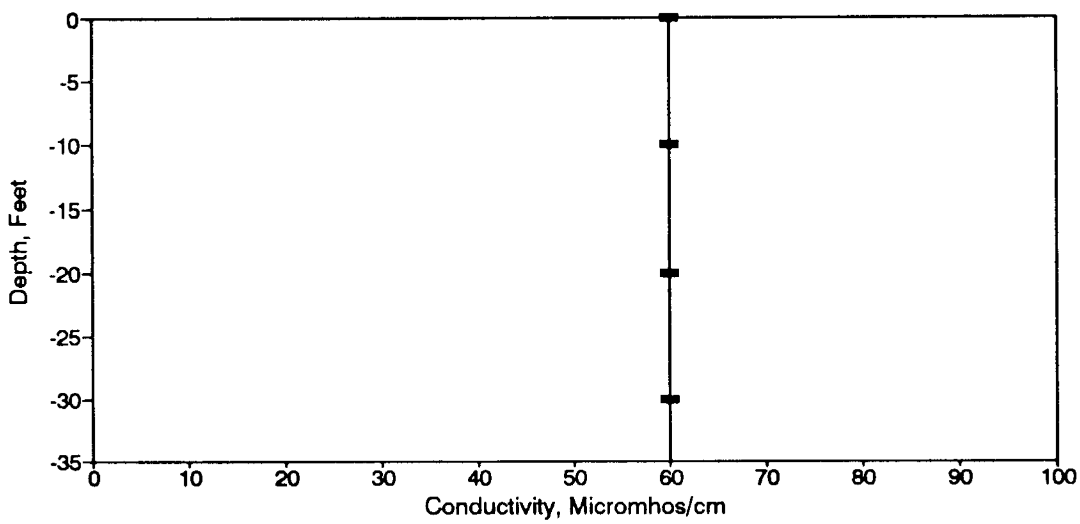

Figure BC51. Conductivity Profile for the Waveland Site-February 26, 1985.

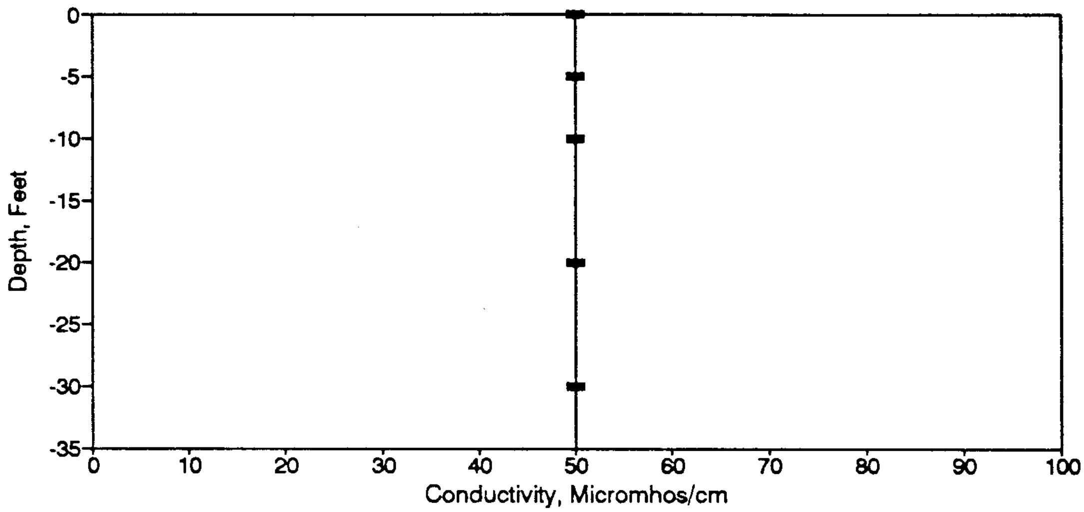

Figure BC52. Conductivity Profile for the Waveland Site-March 19, 1985.

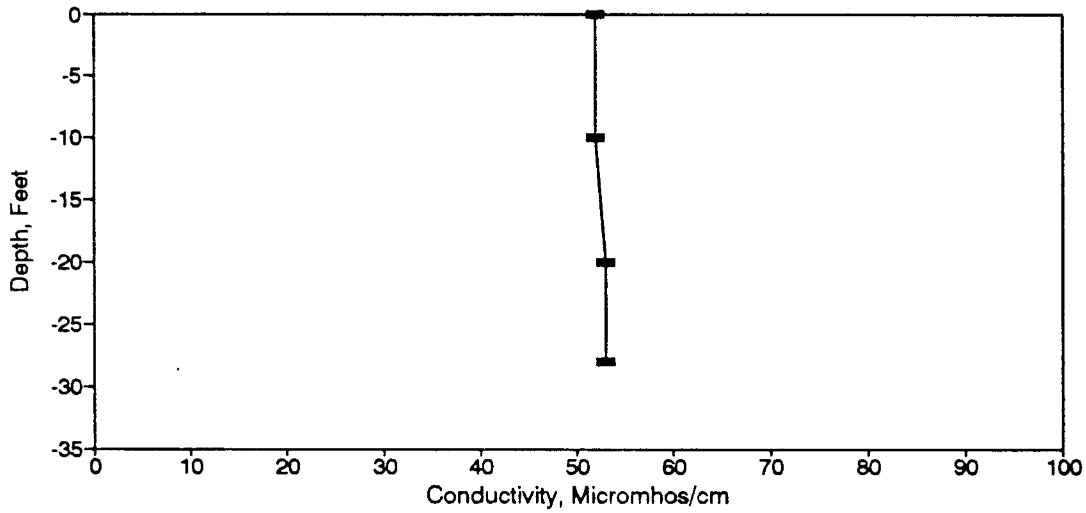

Figure BC53. Conductivity Profile for the Waveland Site-April 23, 1985.

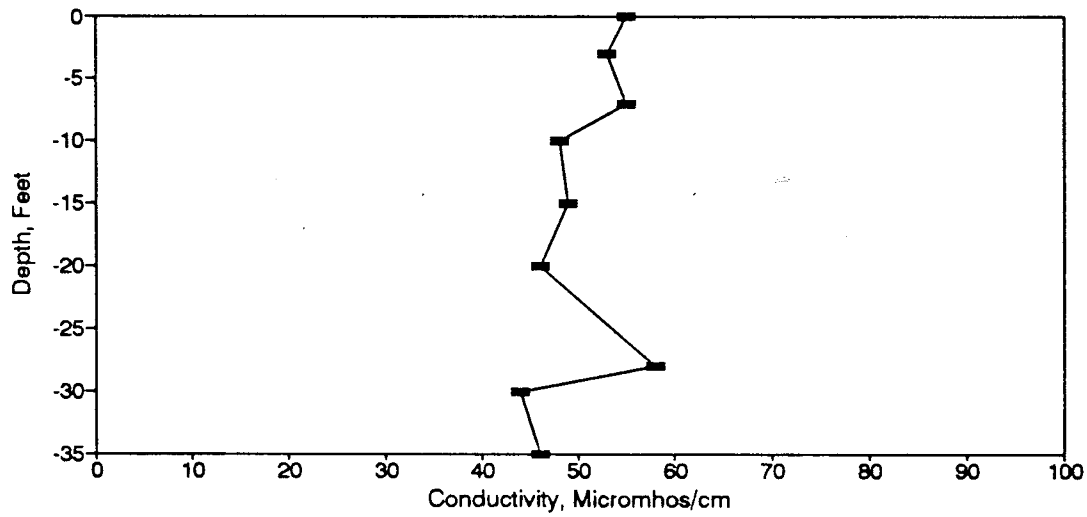

Figure BC54. Conductivity Profile for the Waveland Site-May 28, 1985.

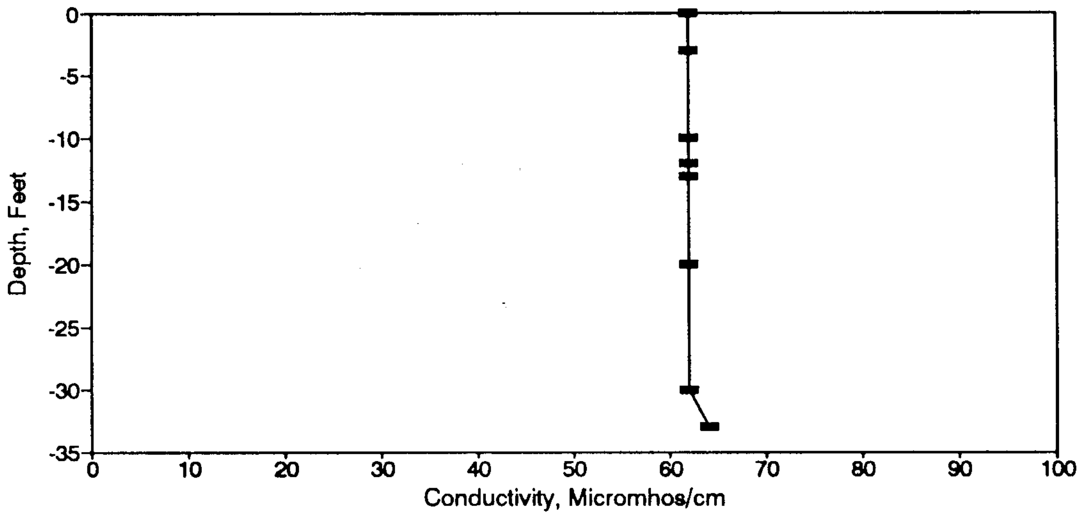

Figure BC55. Conductivity Profile for the Waveland Site-June 17, 1985.

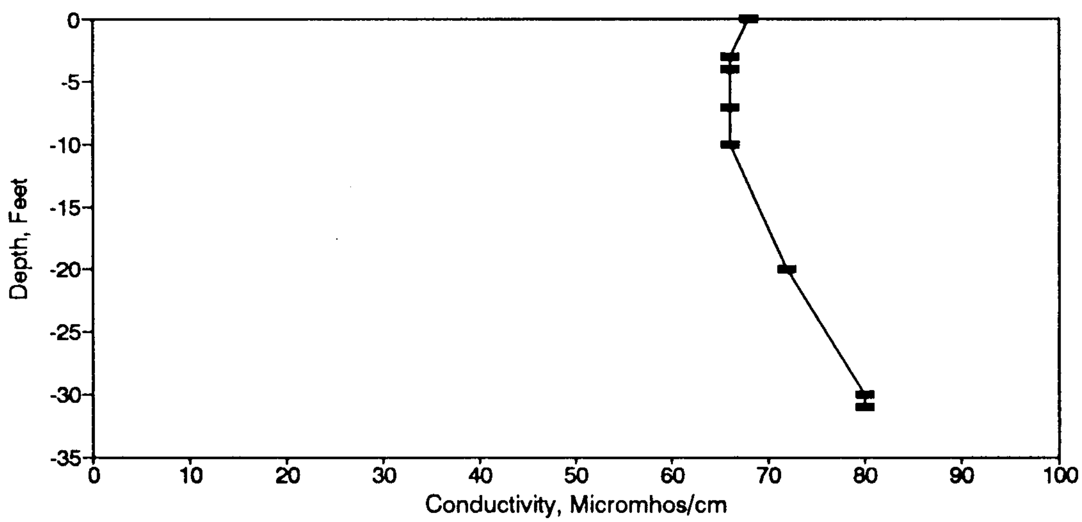

Figure BC56. Conductivity Profile for the Waveland Site-July 22, 1985.

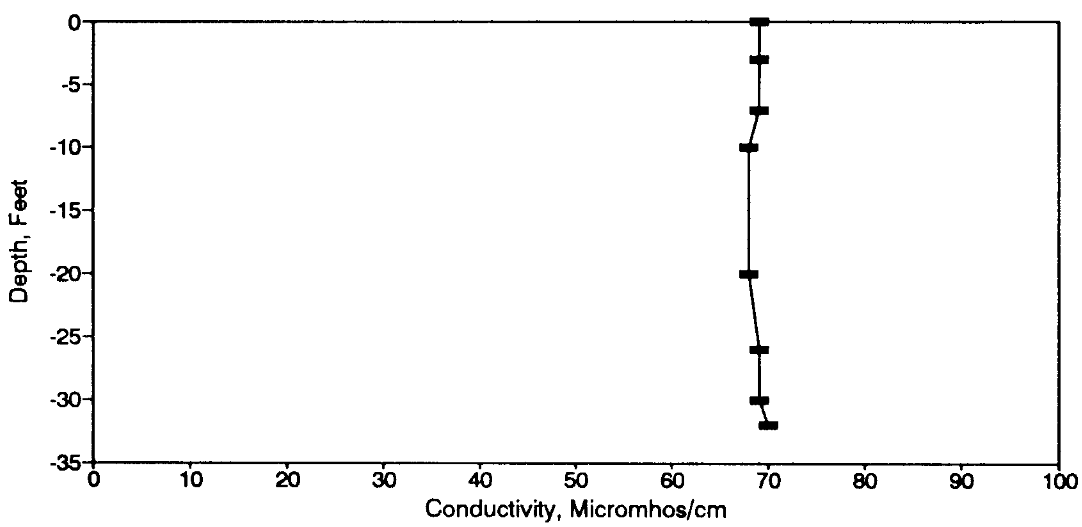

Figure BC57. Conductivity Profile for the Waveland Site-August 23, 1985.

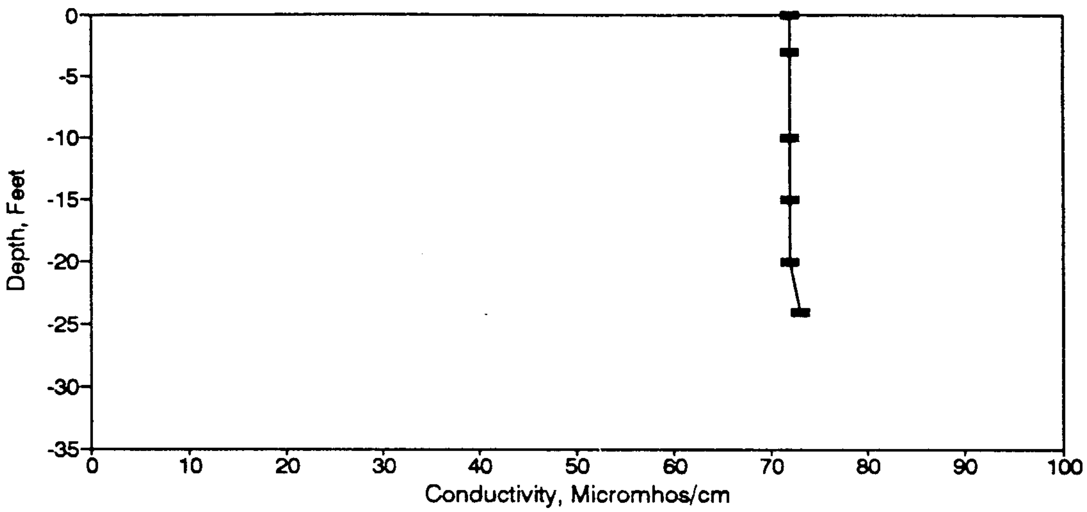

Figure BC58. Conductivity Profile for the Waveland Site-September 23, 1985.

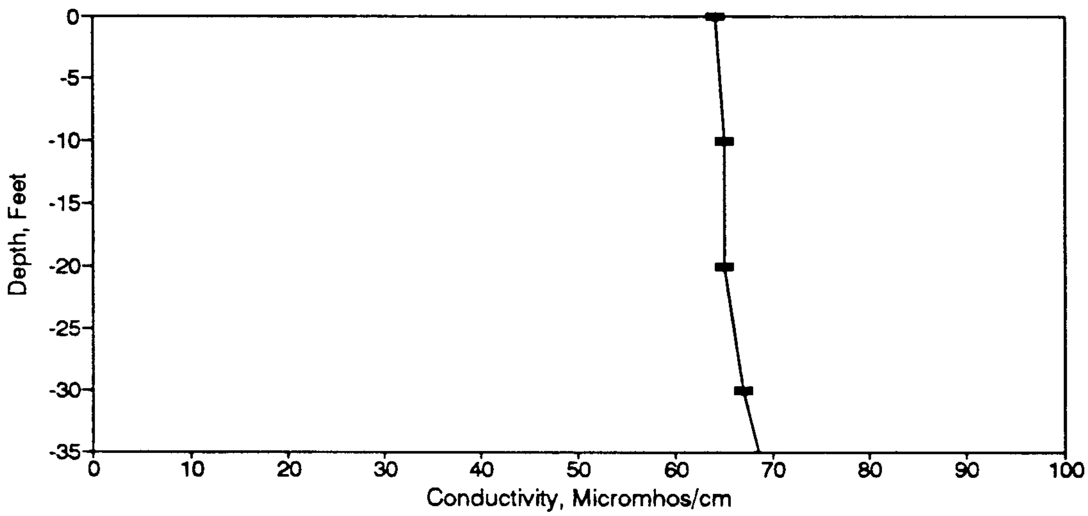

Figure BC59. Conductivity Profile for the Waveland Site-October 16, 1985.

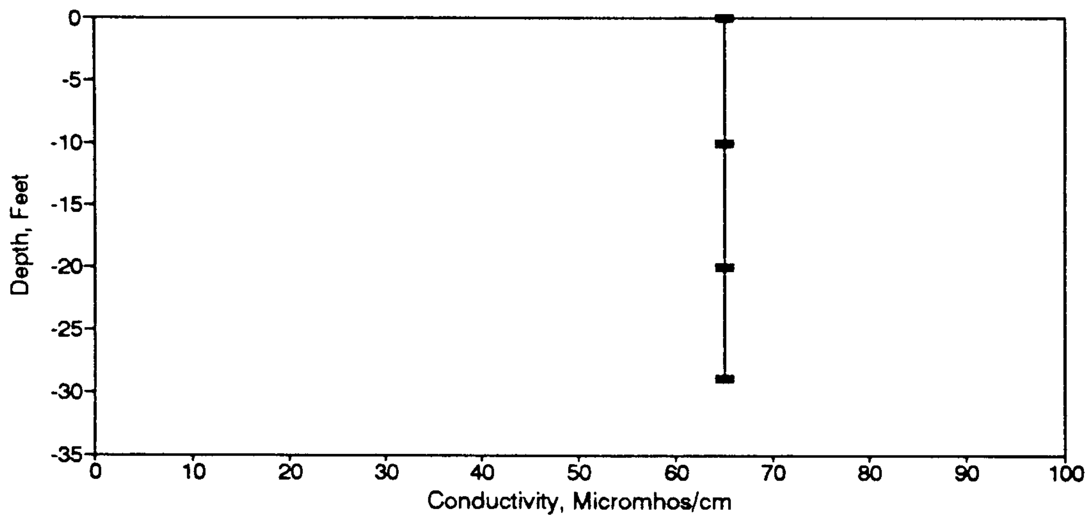

Figure BC60. Conductivity Profile for the Waveland Site-November 18, 1985.

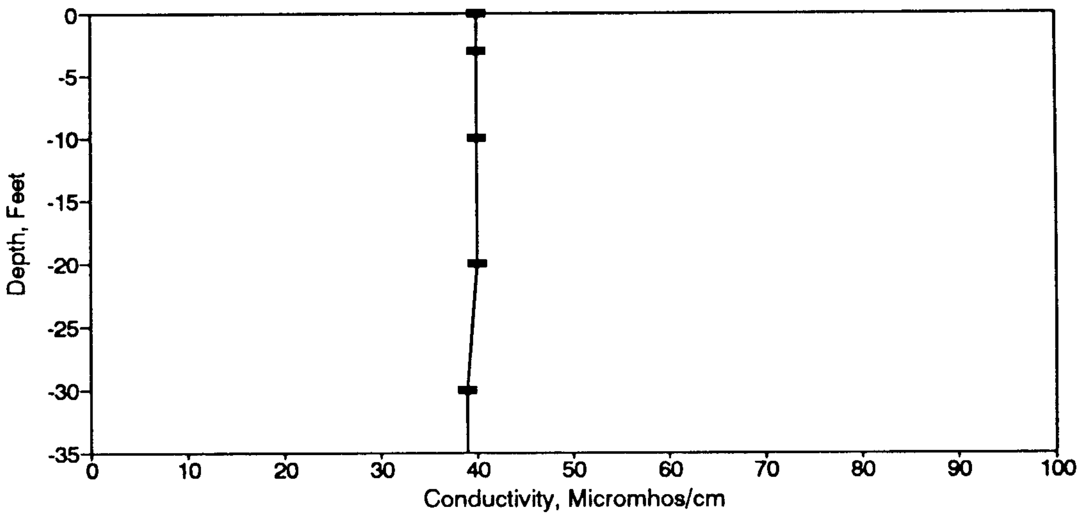

Figure BC61. Conductivity Profile for the Waveland Site-December 12, 1985.

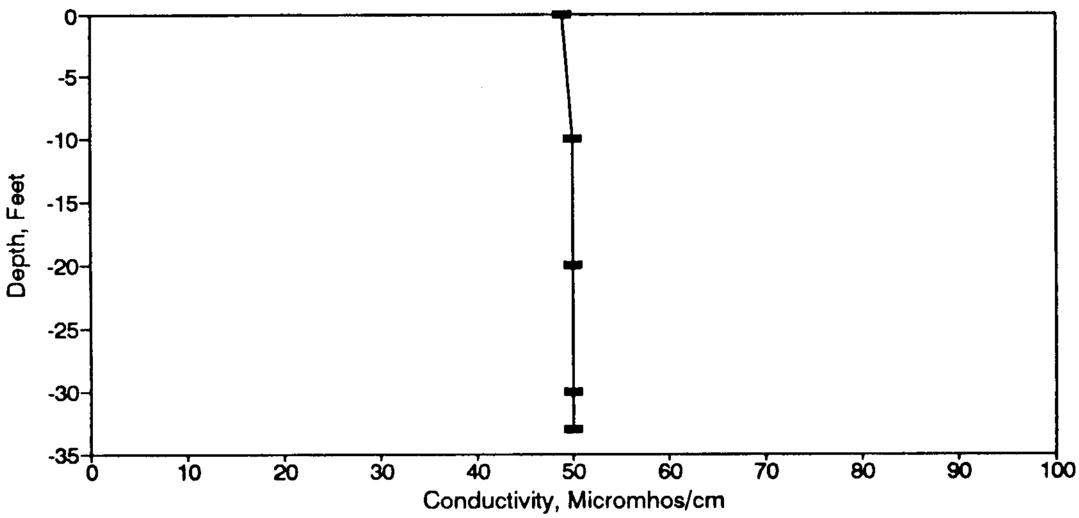

Figure BC62. Conductivity Profile for the Waveland Site-January 14, 1986.

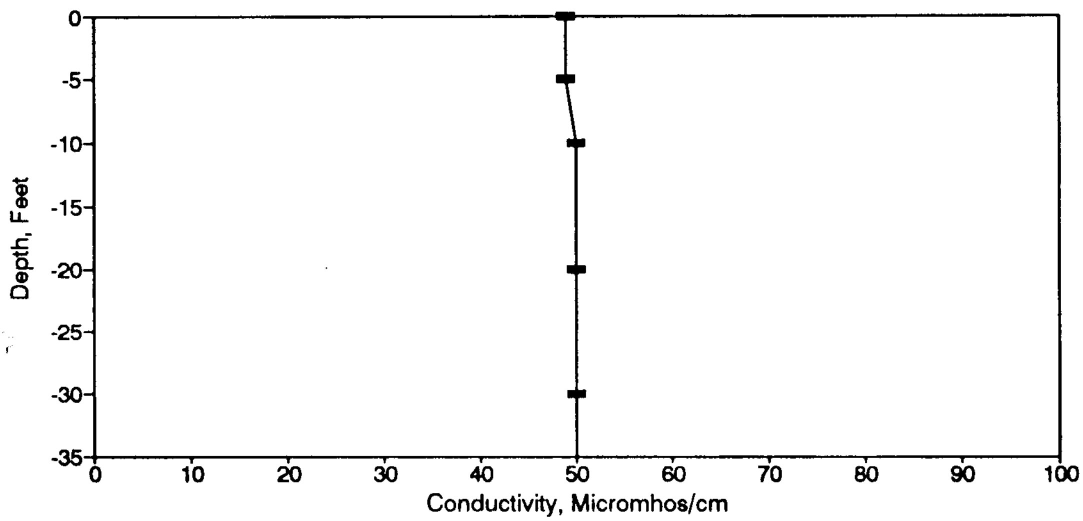

Figure BC63. Conductivity Profile for the Waveland Site-February 3, 1986.

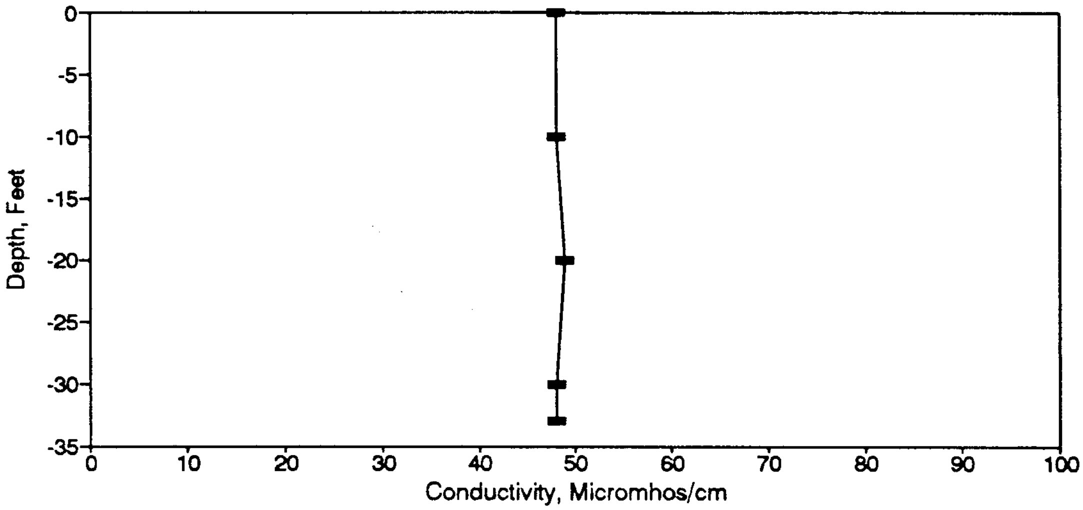

Figure BC64. Conductivity Profile for the Waveland Site-March 11, 1986.

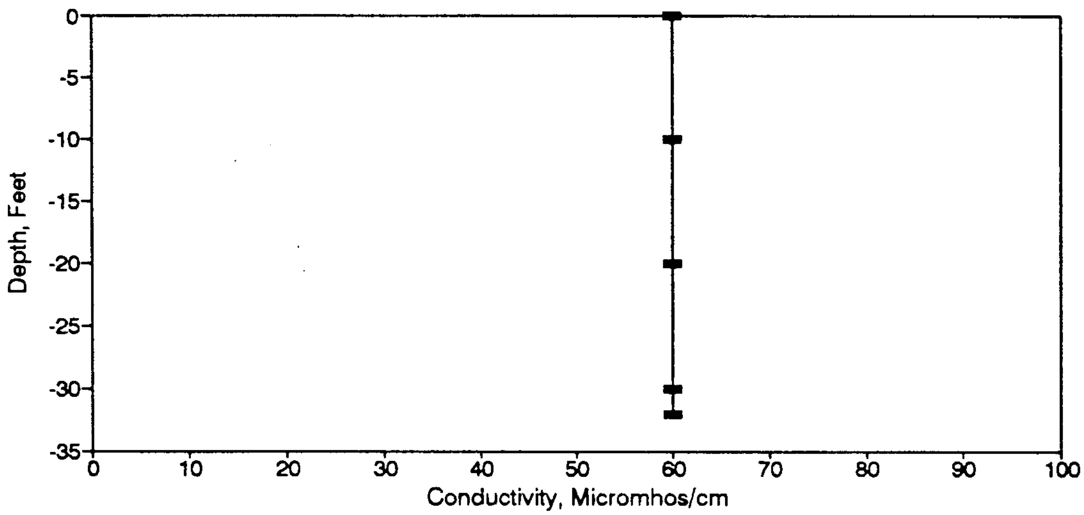

Figure BC65. Conductivity Profile for the Waveland Site-April 14, 1986.

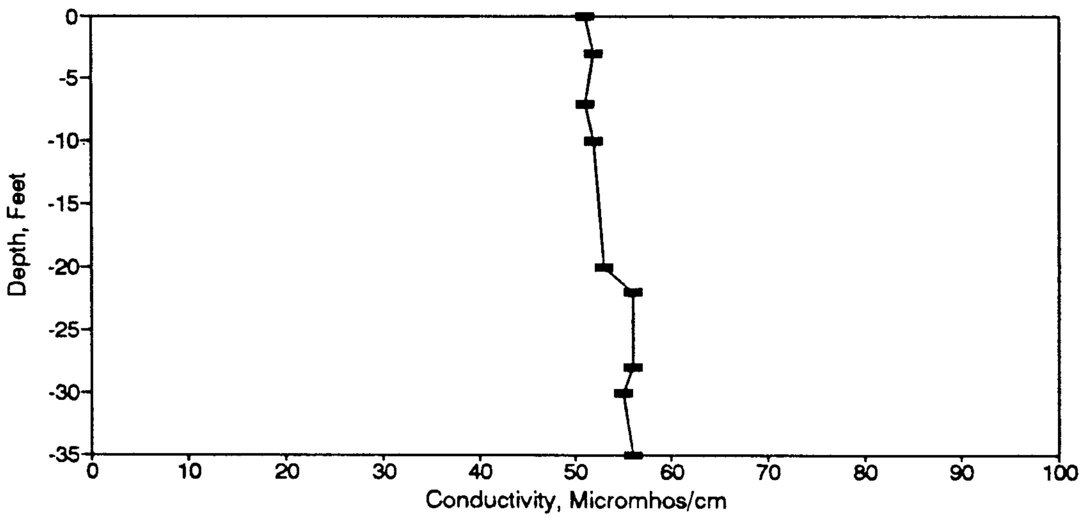

Figure BC66. Conductivity Profile for the Waveland Site-May 15, 1986.

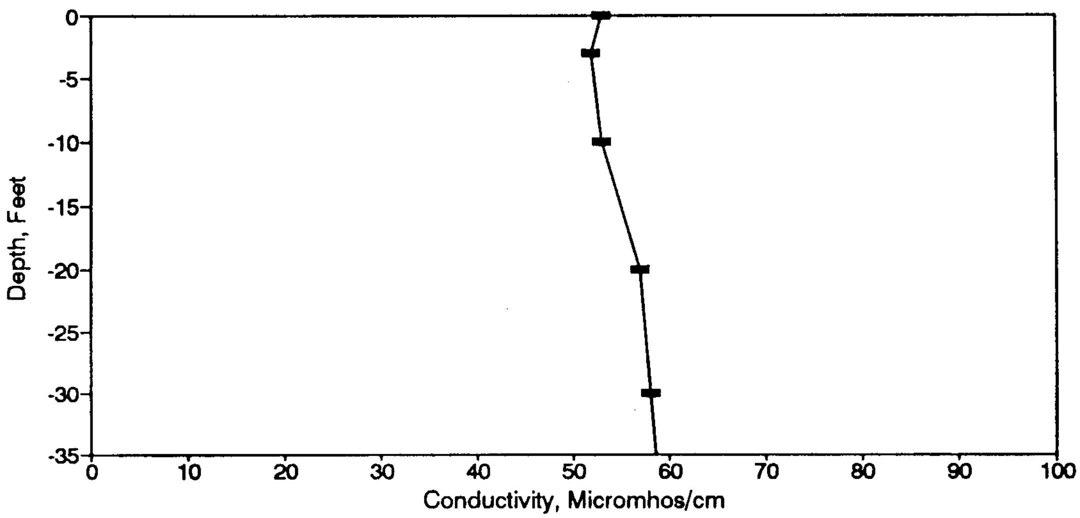

Figure BC67. Conductivity Profile for the Waveland Site-June 9, 1986.

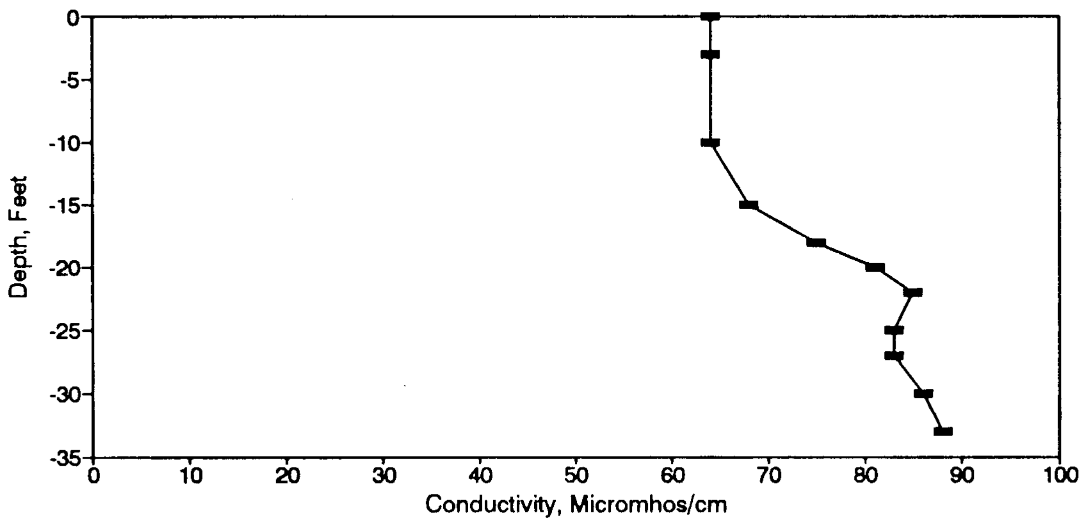

Figure BC68. Conductivity Profile for the Waveland Site-July 15, 1986.

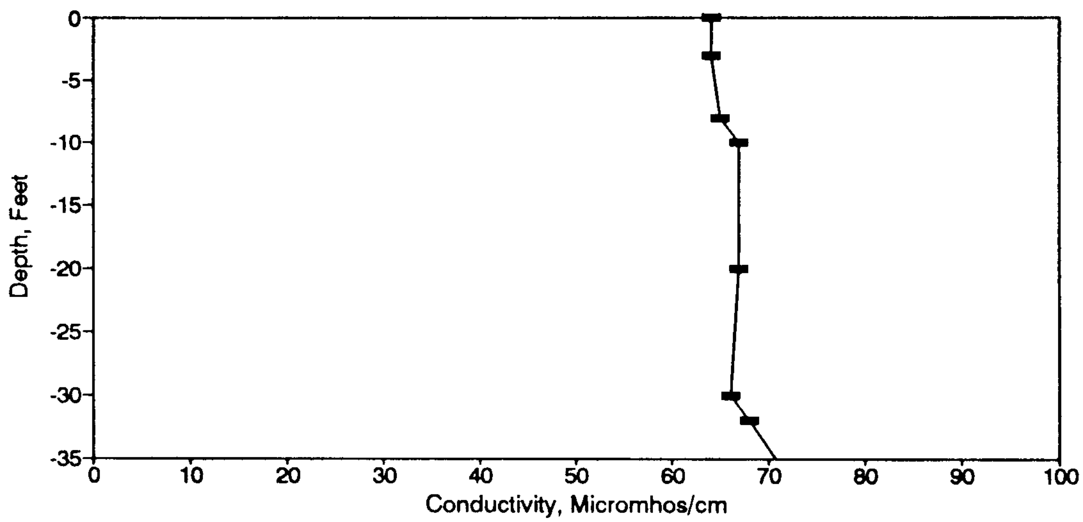

Figure BC69. Conductivity Profile for the Waveland Site-August 21, 1986.

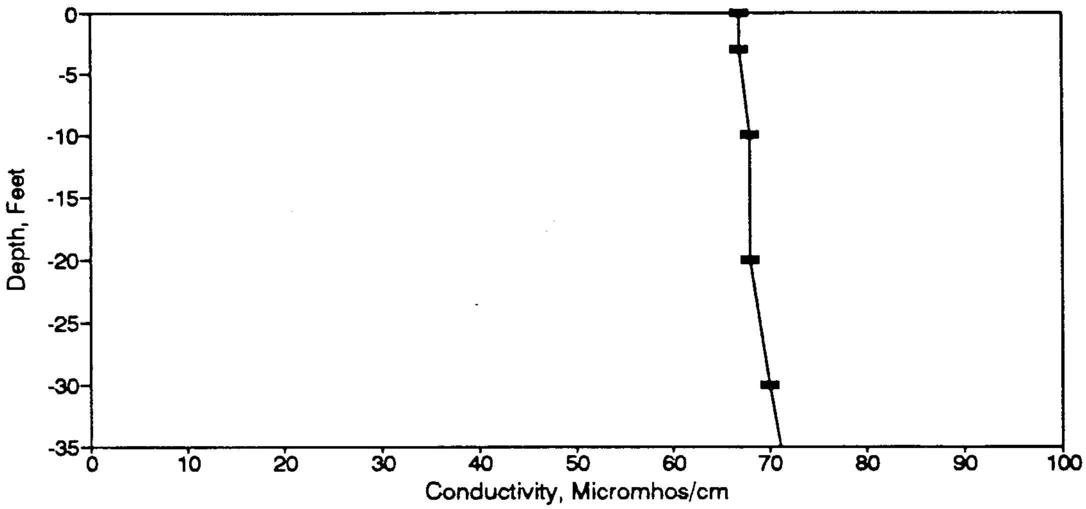

Figure BC70. Conductivity Profile for the Waveland Site-September 10, 1986.

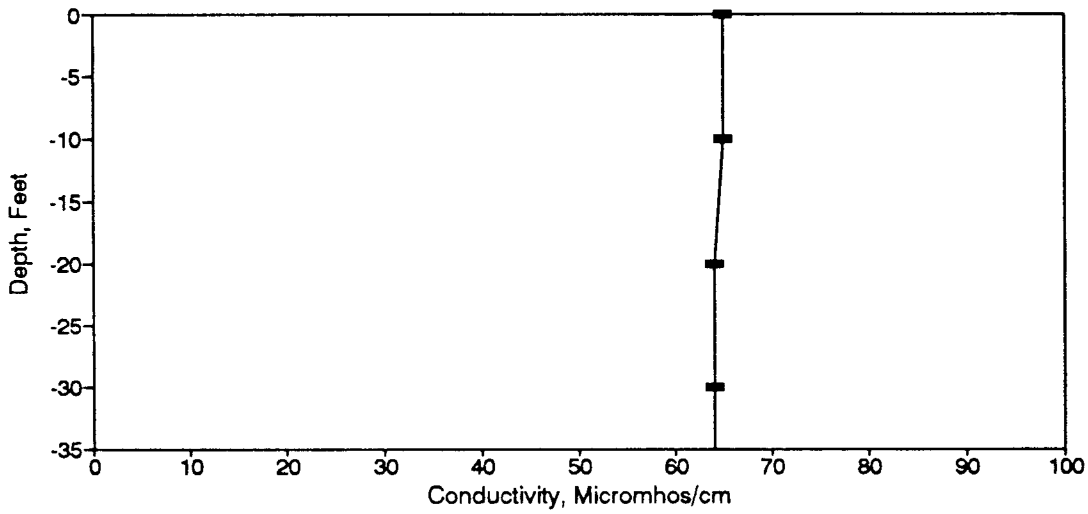

Figure BC71. Conductivity Profile for the Waveland Site-October 14, 1986.

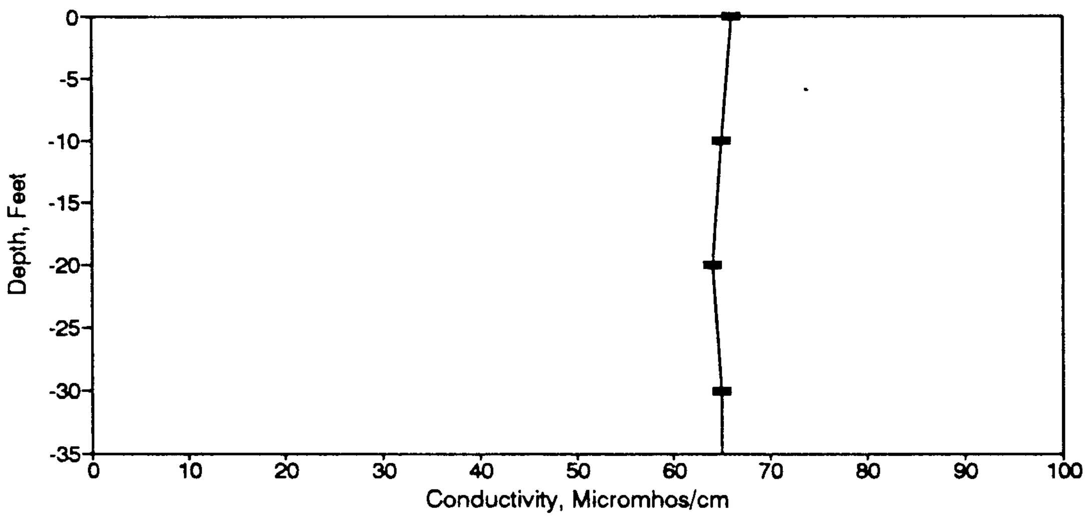

Figure BC72. Conductivity Profile for the Waveland Site-November 3, 1986.

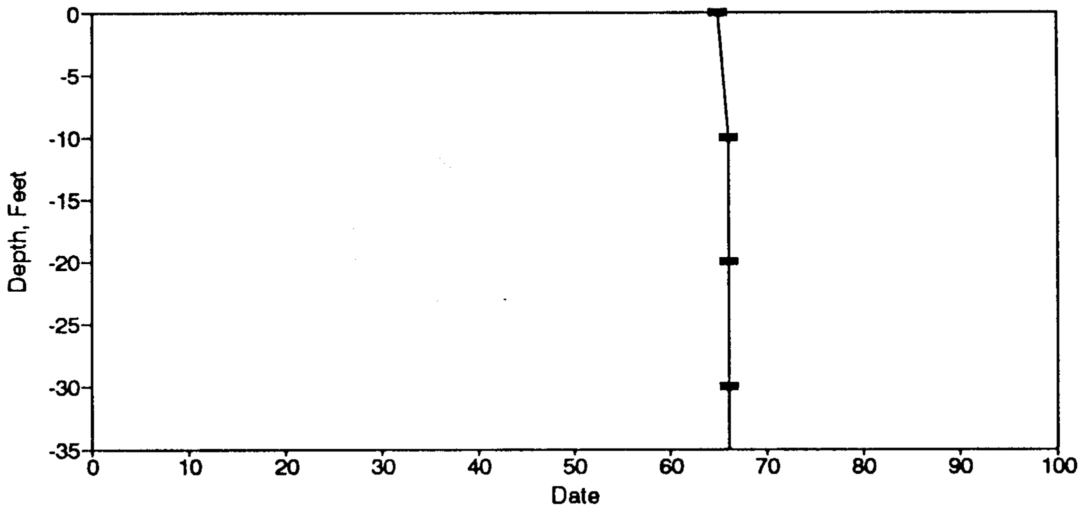

Figure BC73. Conductivity Profile for the Waveland Site-December 8, 1986.

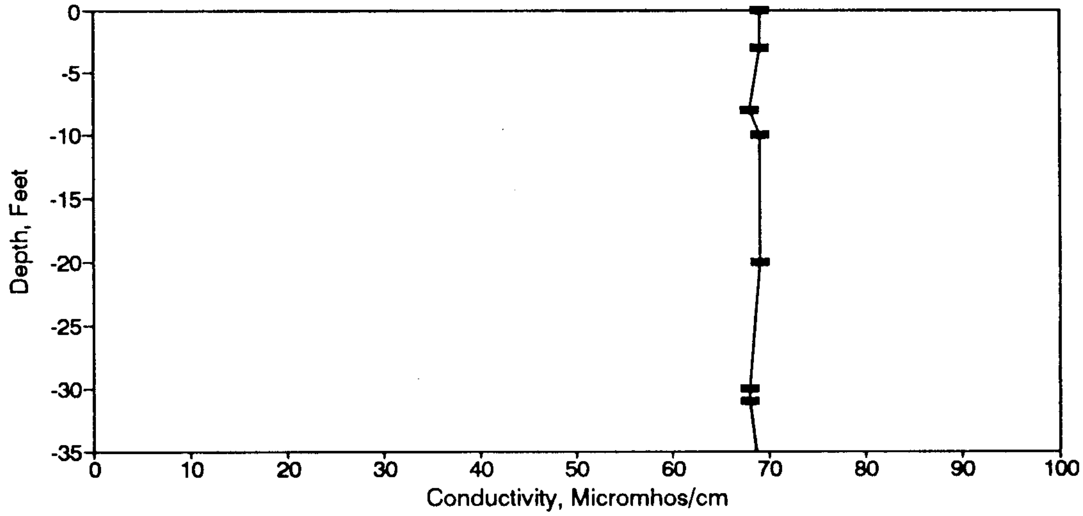

Figure BC74. Conductivity Profile for the Waveland Site-January 15, 1987.

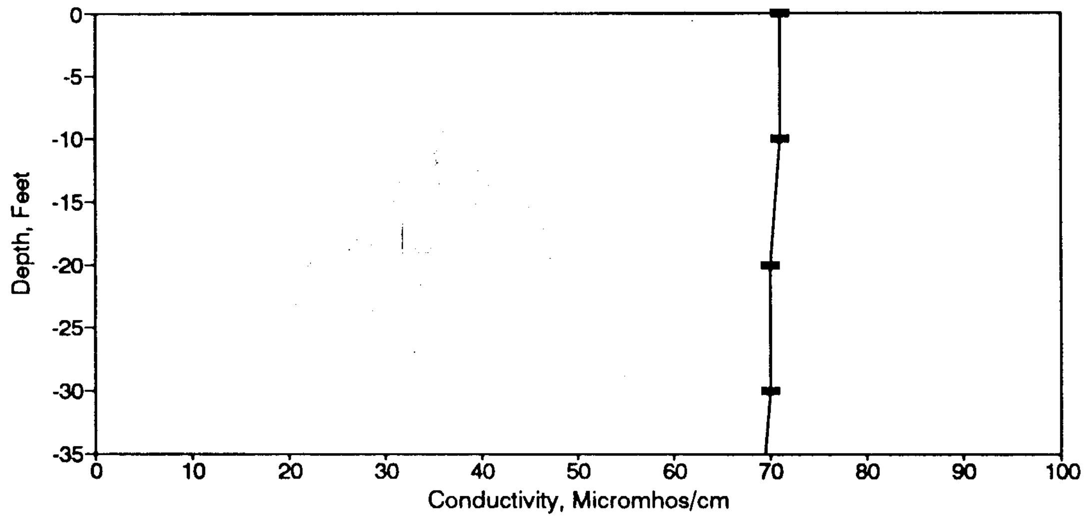

Figure BC75. Conductivity Profile for the Waveland Site-February 10, 1987.

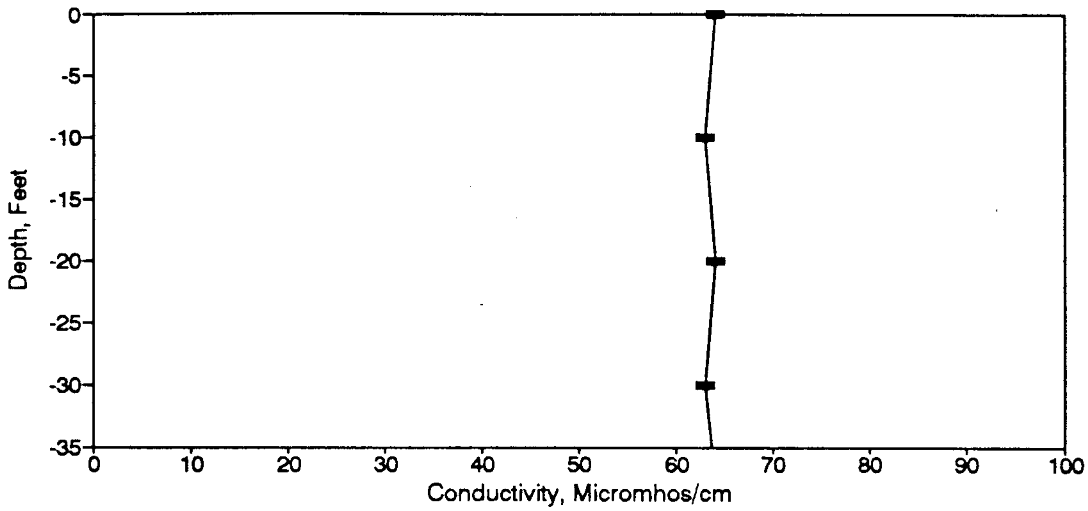

Figure BC76. Conductivity Profile for the Waveland Site-March 2, 1987.

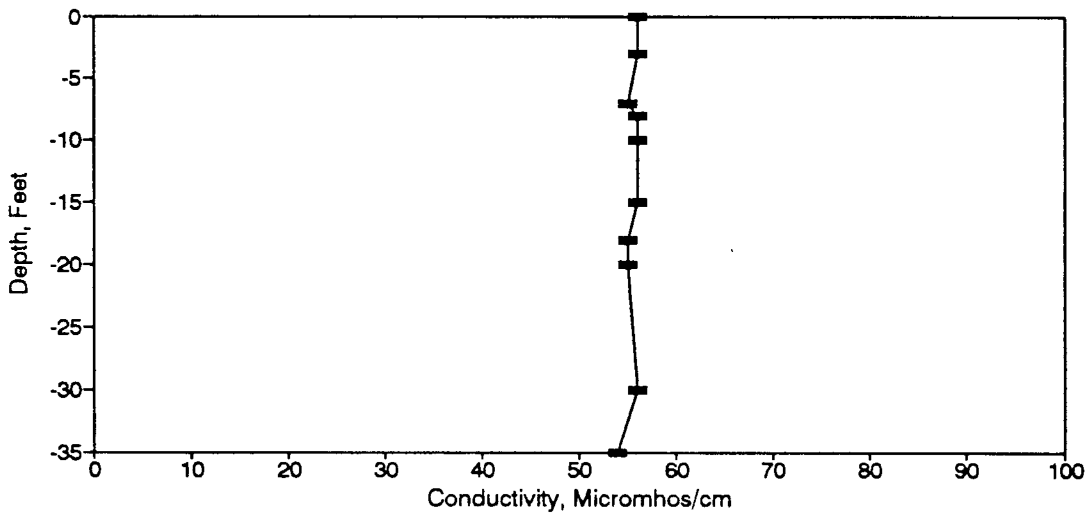

Figure BC77. Conductivity Profile for the Waveland Site-April 30, 1987.

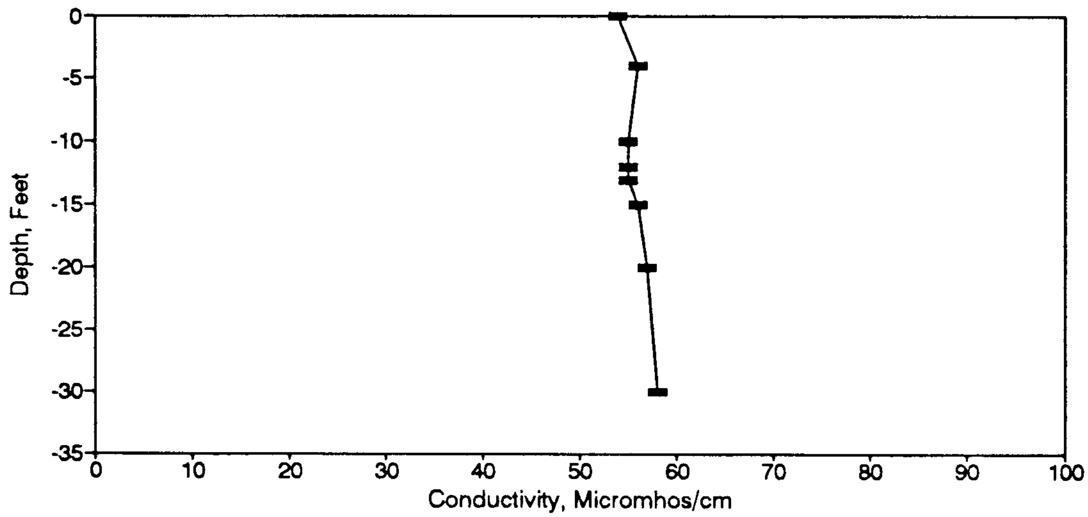

Figure BC78. Conductivity Profile for the Waveland Site-May 15, 1987.

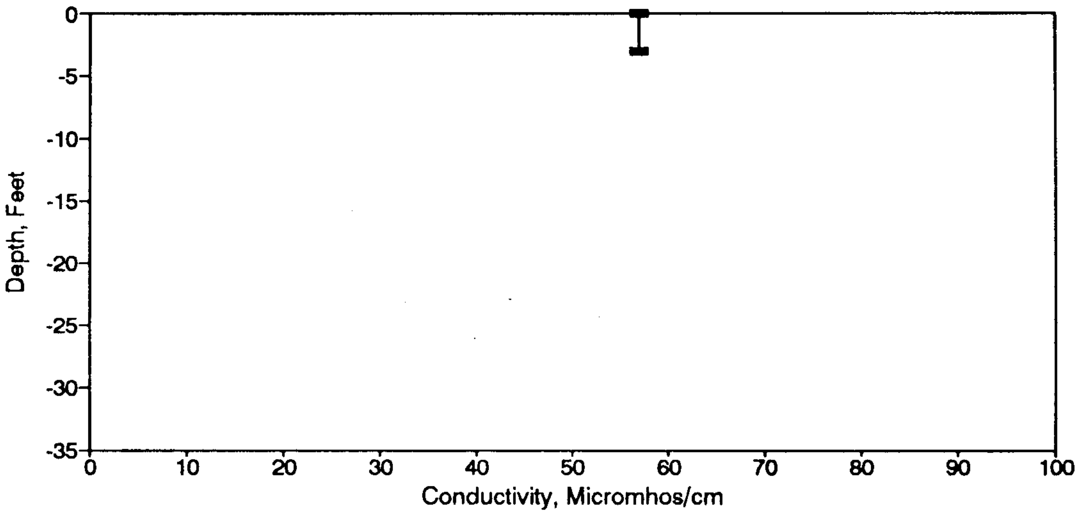

Figure BC79. Conductivity Profile for the Waveland Site-June 1, 1987.

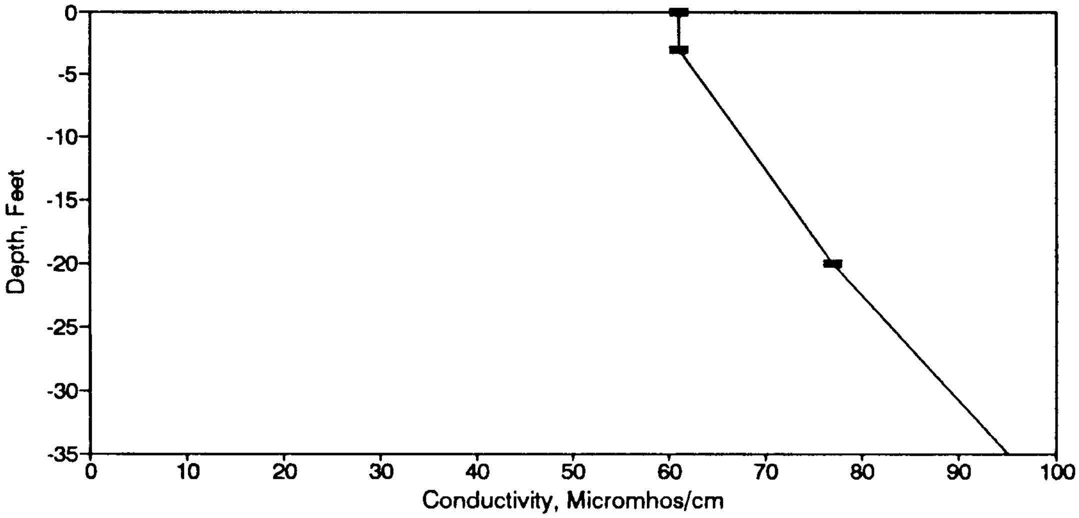

Figure BC80. Conductivity Profile for the Waveland Site-July 6, 1987.

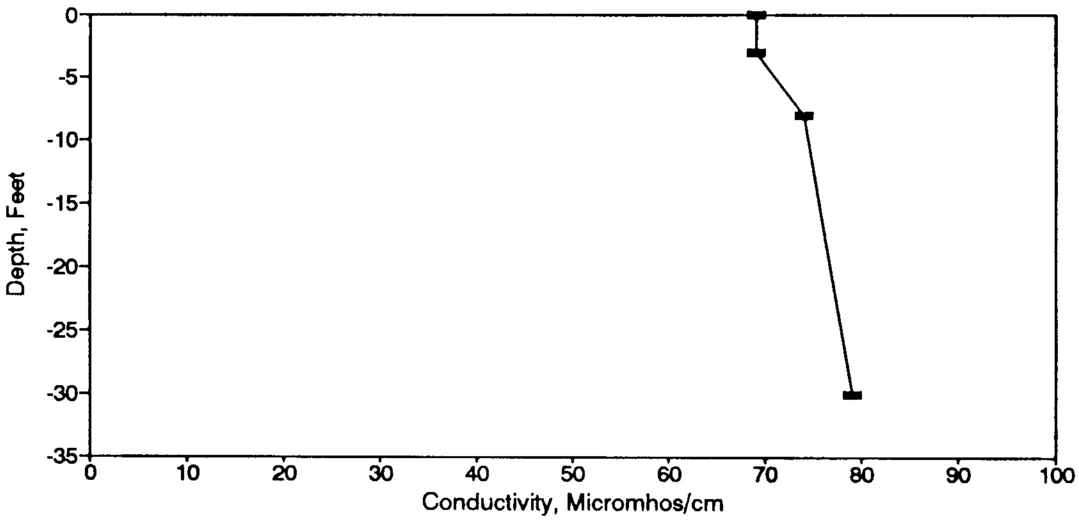

Figure BC81. Conductivity Profile for the Waveland Site-August 6, 1987.

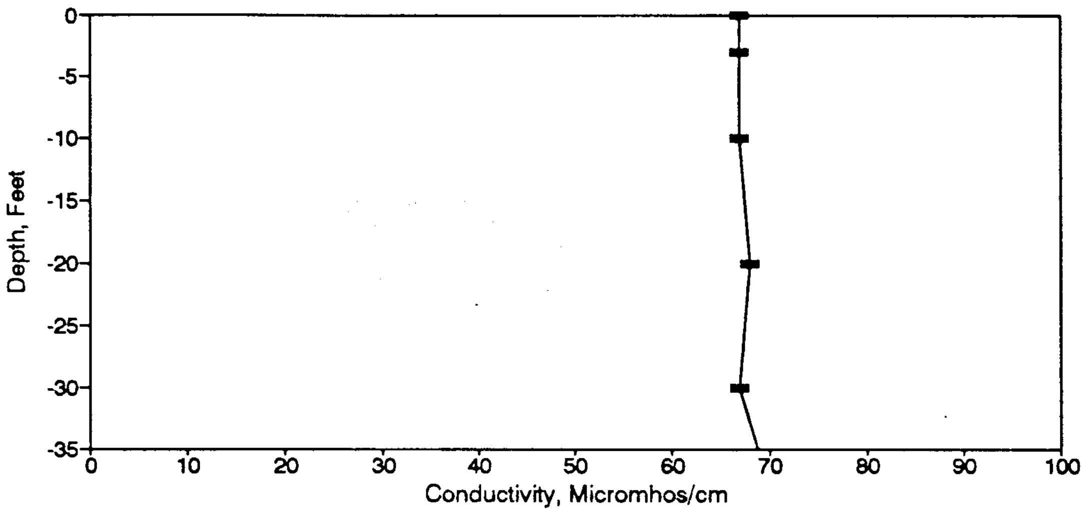

Figure BC82. Conductivity Profile for the Waveland Site-September 2, 1987.

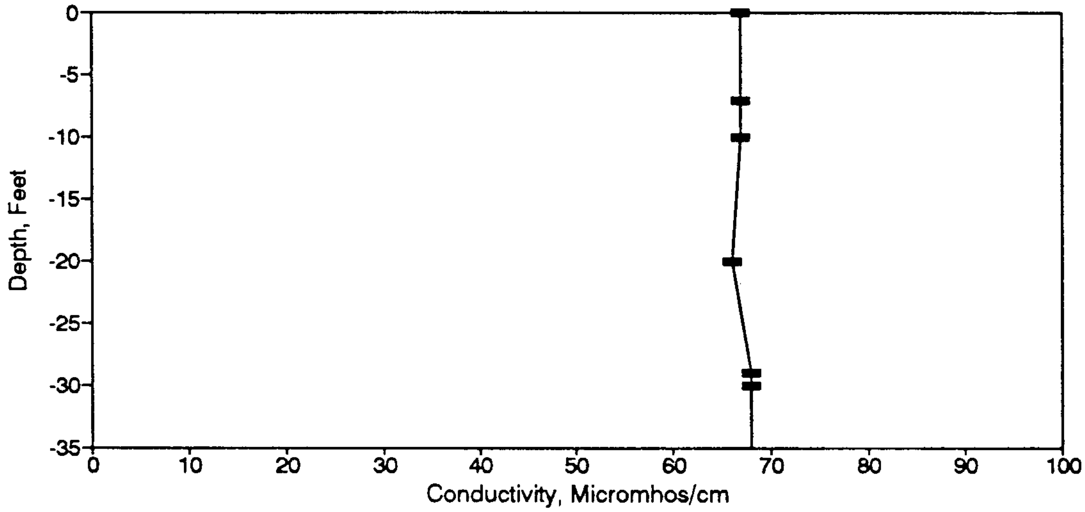

Figure BC83. Conductivity Profile for the Waveland Site-October 6, 1987.

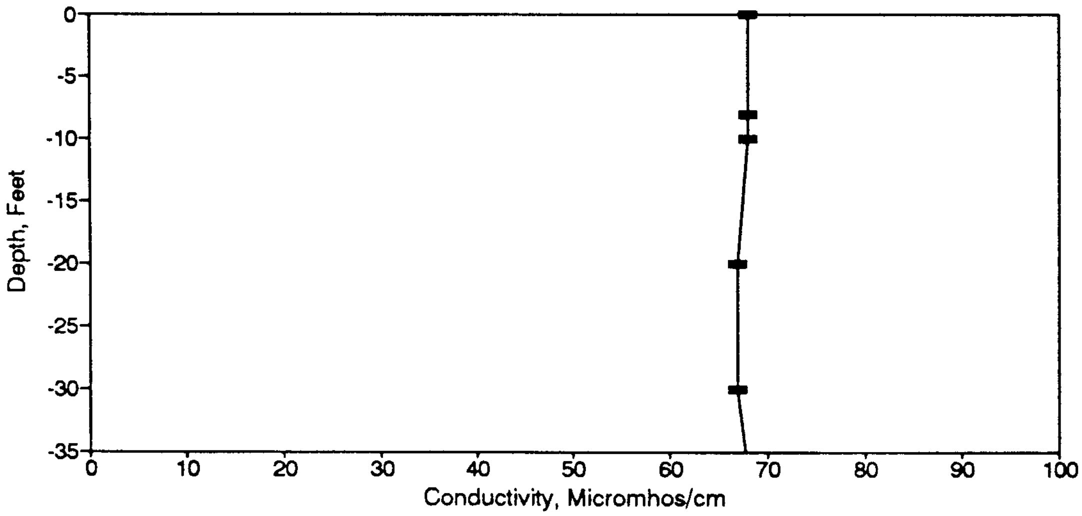

Figure BC84. Conductivity Profile for the Waveland Site-November 2, 1987.

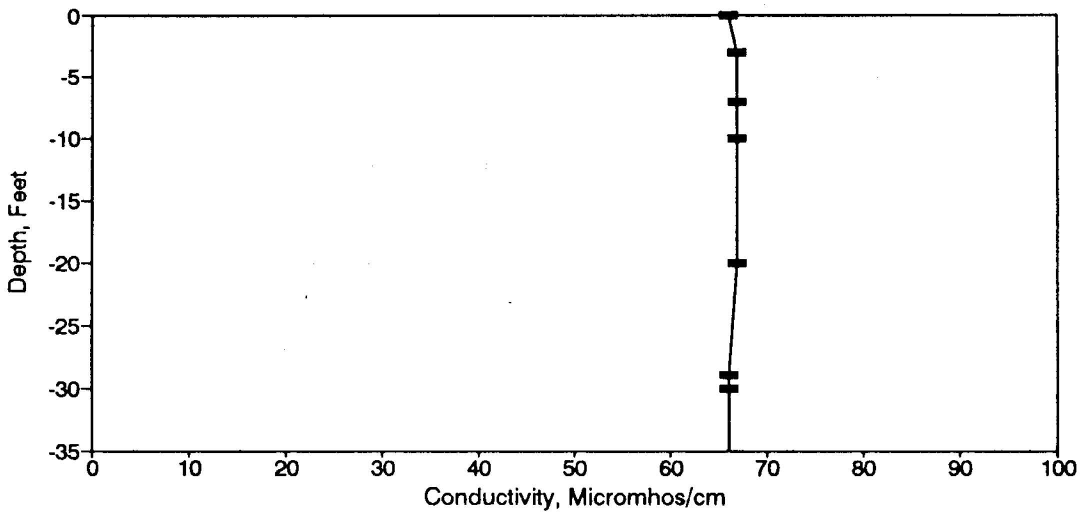

Figure BC85. Conductivity Profile for the Waveland Site-December 3, 1987.

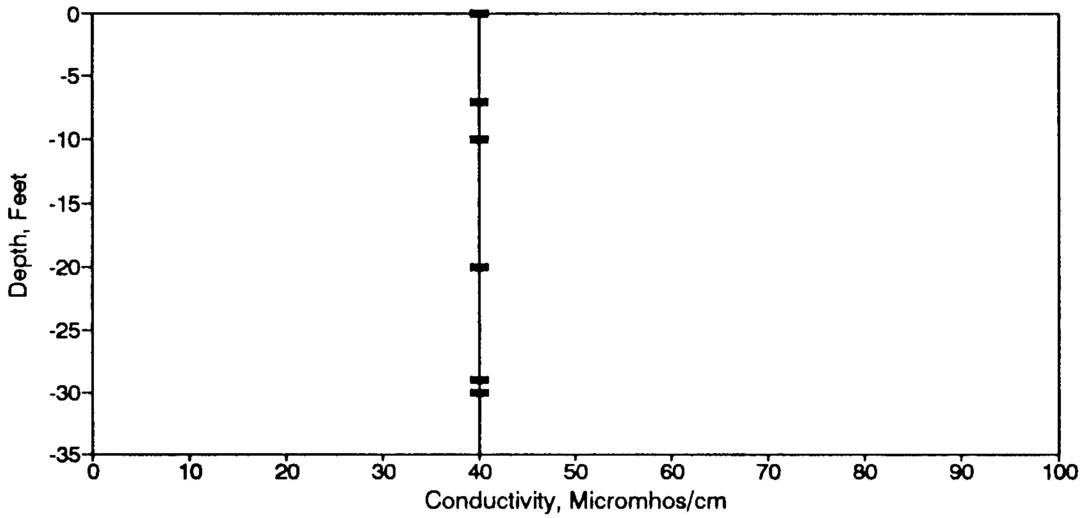

Figure BC86. Conductivity Profile for the Waveland Site-January 25, 1988.

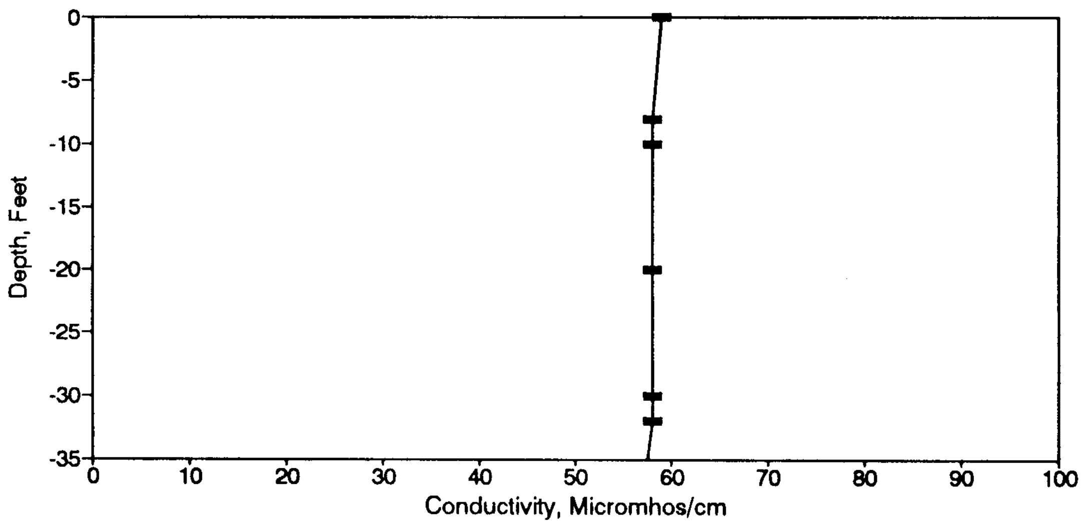

Figure BC87. Conductivity Profile for the Waveland Site-February 16, 1988.

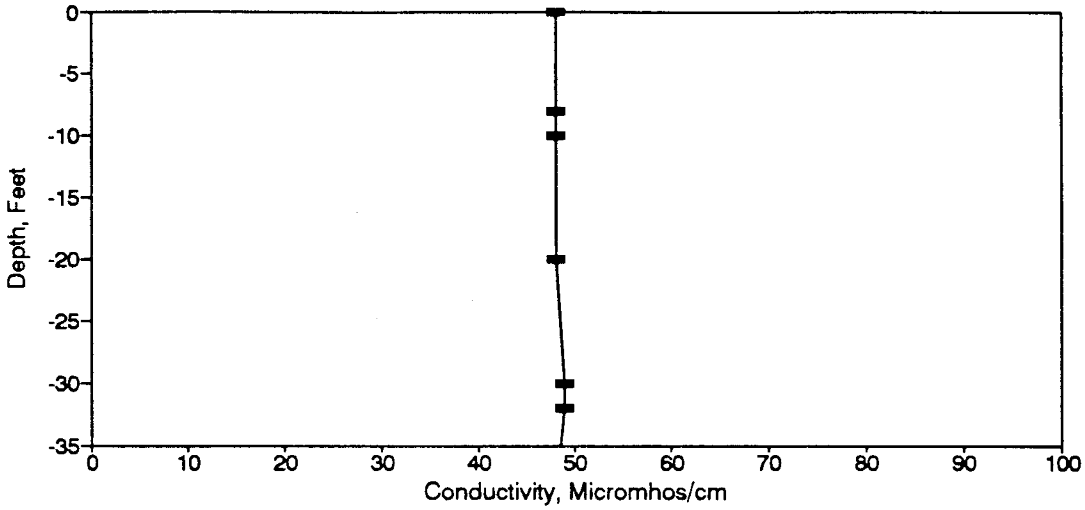

Figure BC88. Conductivity Profile for the Waveland Site-March 9, 1988.

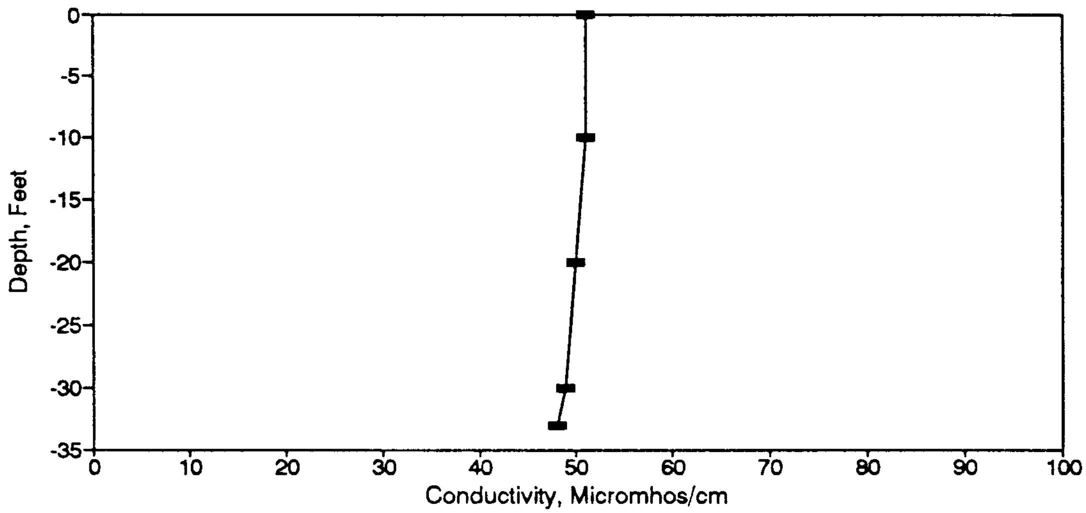

Figure BC89. Conductivity Profile for the Waveland Site-April 25, 1988.

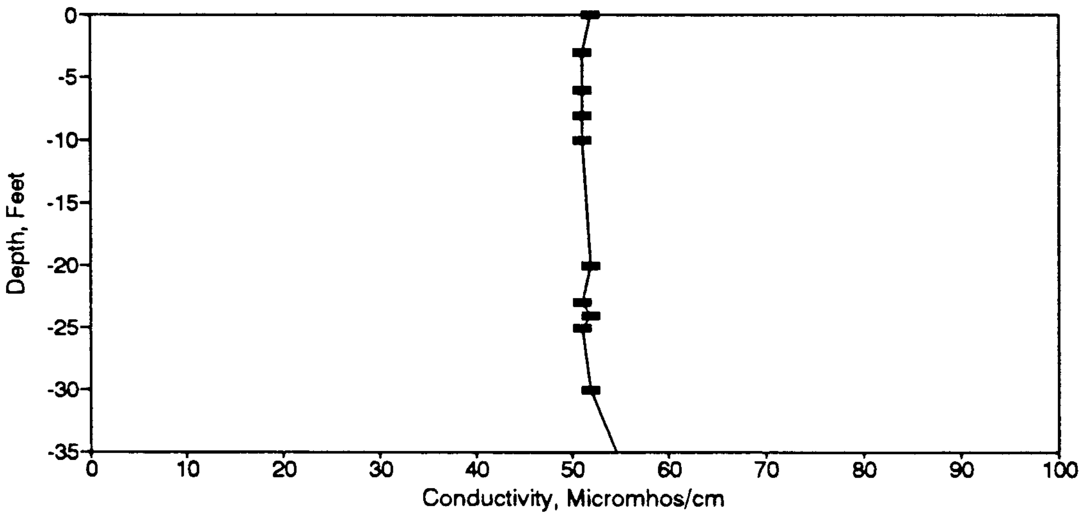

Figure BC90. Conductivity Profile for the Waveland Site-May 12, 1988.

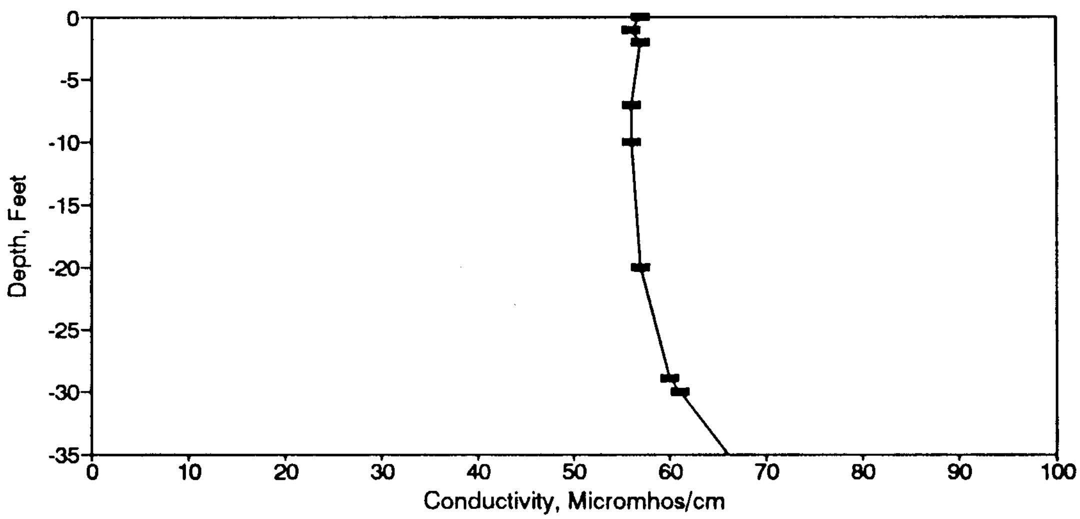

Figure BC91. Conductivity Profile for the Waveland Site-June 15, 1988.

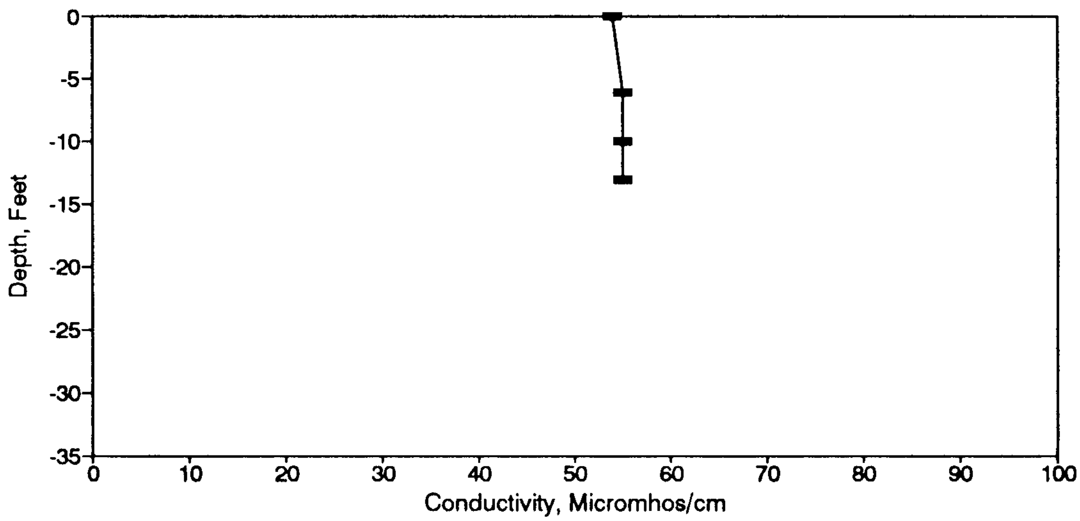

Figure BC92. Conductivity Profile for the Waveland Site-July 6, 1988.

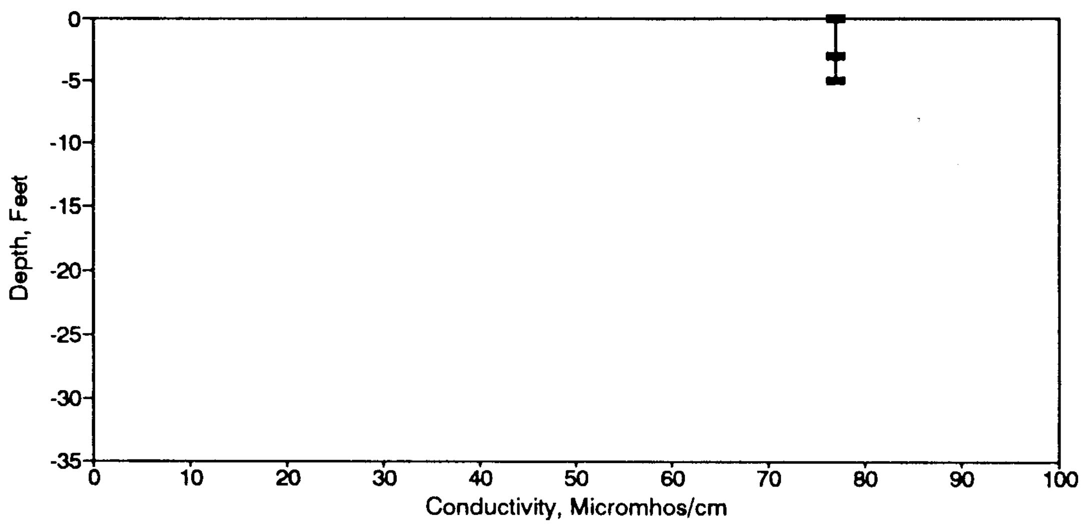

Figure BC93. Conductivity Profile for the Waveland Site-August 11, 1988.

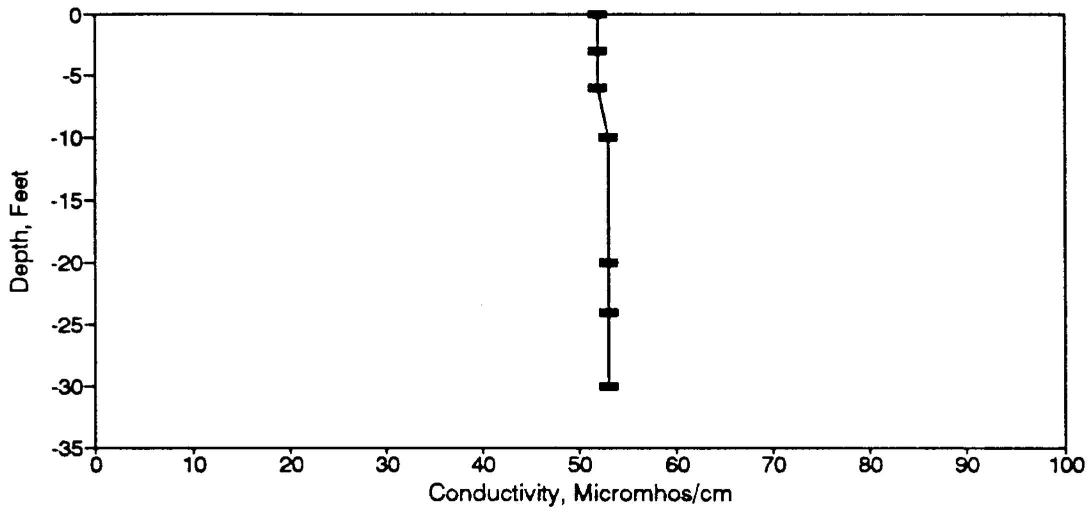

Figure BC94. Conductivity Profile for the Waveland Site-January 12, 1989.

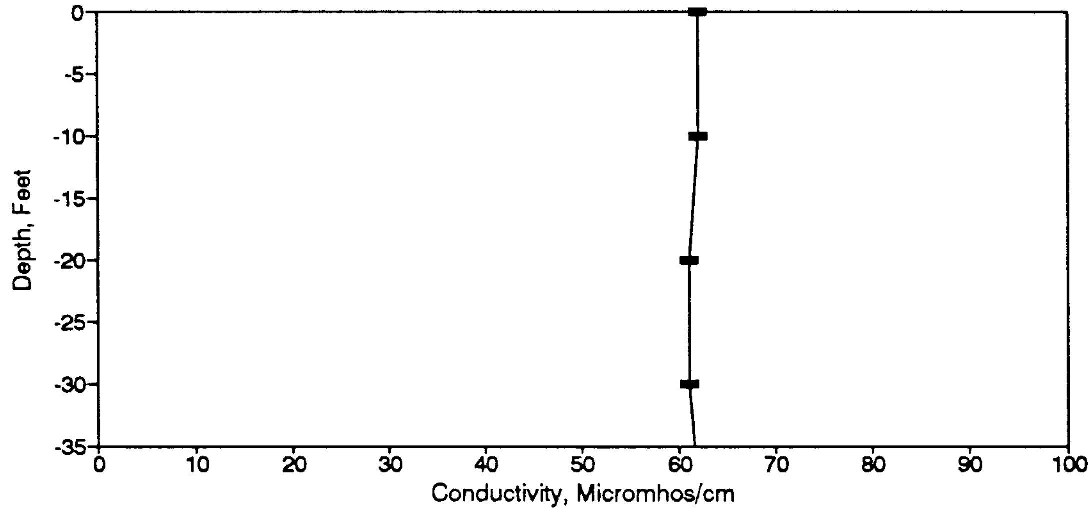

Figure BC95. Conductivity Profile for the Waveland Site-February 1, 1989.

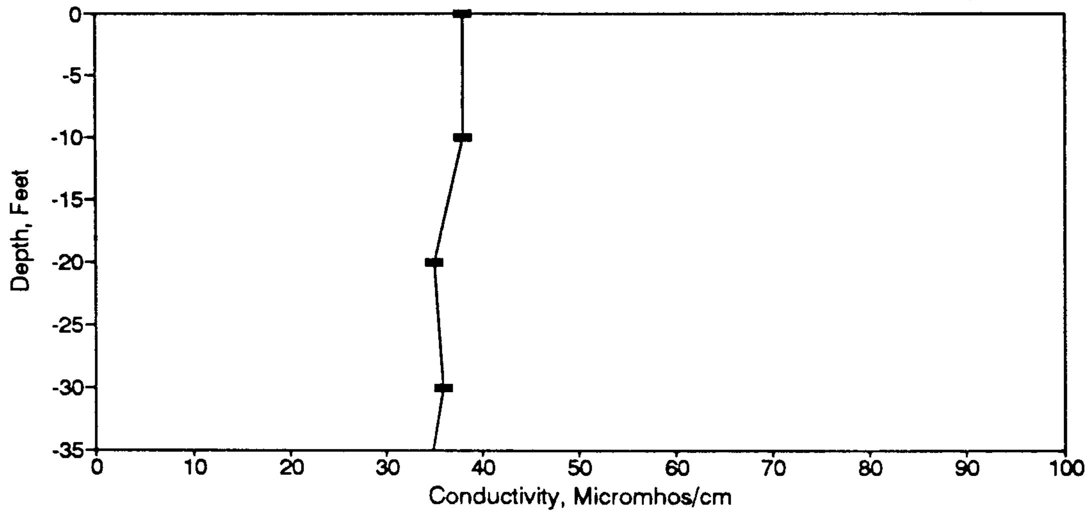

Figure BC96. Conductivity Profile for the Waveland Site-March 20, 1989.

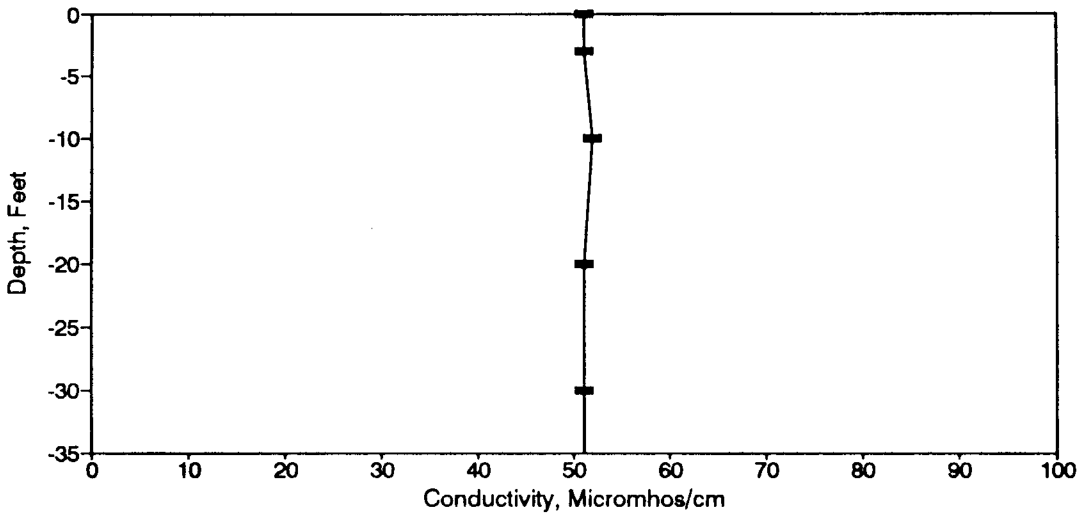

Figure BC97. Conductivity Profile for the Waveland Site-April 17, 1989.

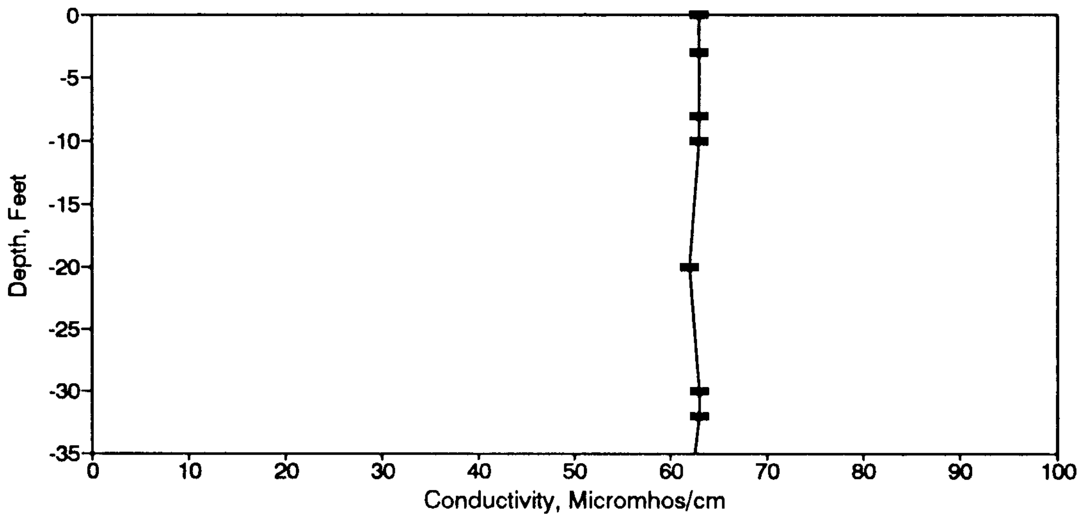

Figure BC98. Conductivity Profile for the Waveland Site-May 11, 1989.

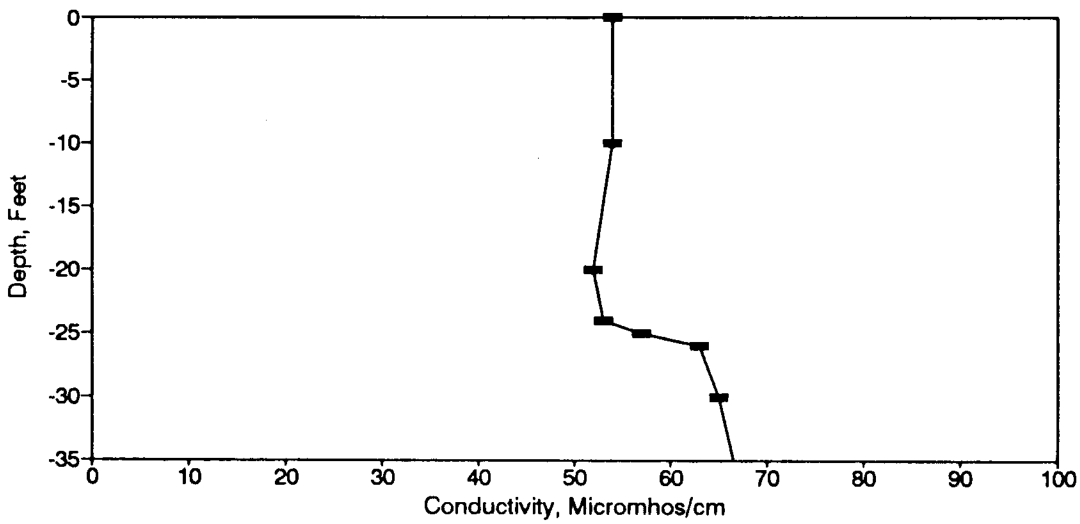

Figure BC99. Conductivity Profile for the Waveland Site-June 19, 1989.

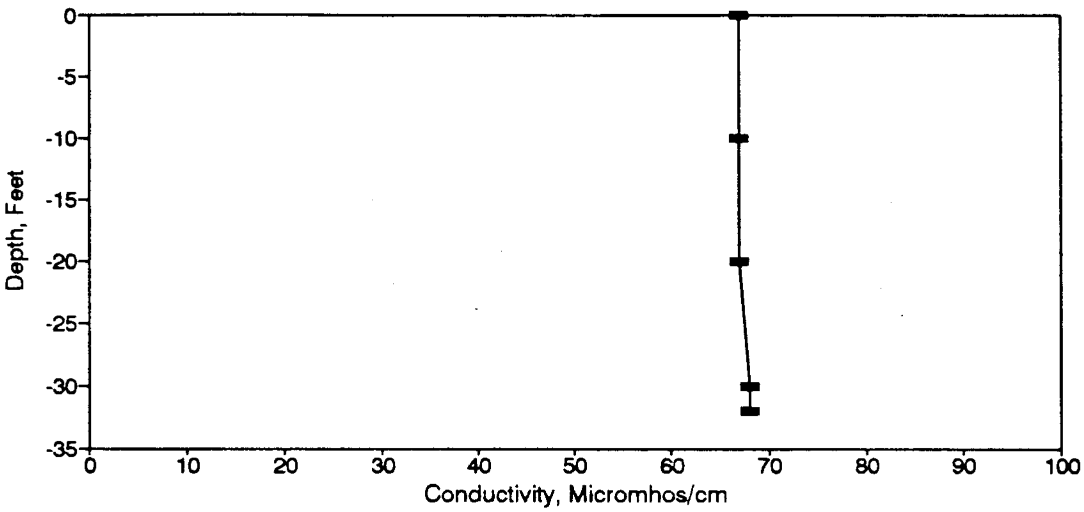

Figure BC100. Conductivity Profile for the Waveland Site-July 17, 1989.

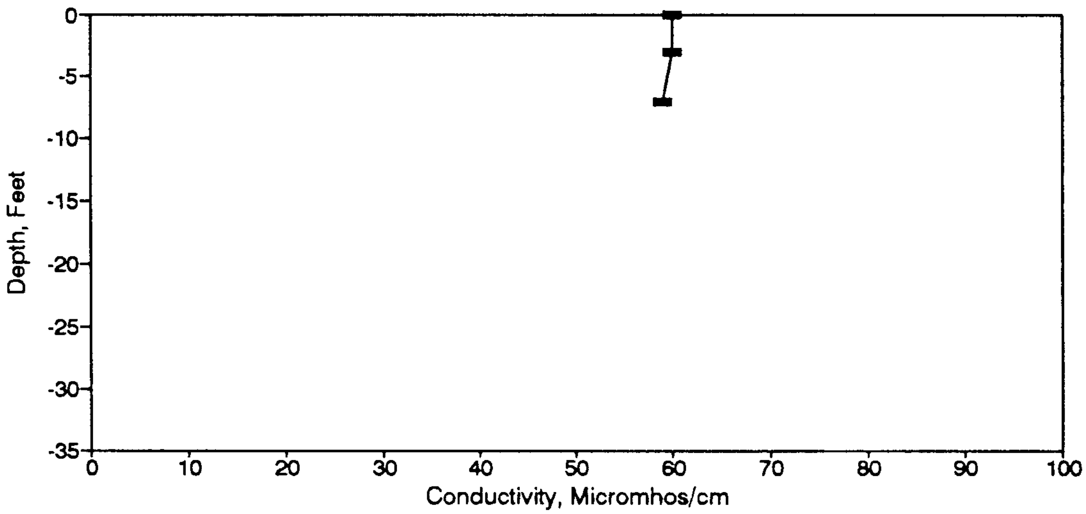

Figure BC101. Conductivity Profile for the Waveland Site-August 7, 1989.

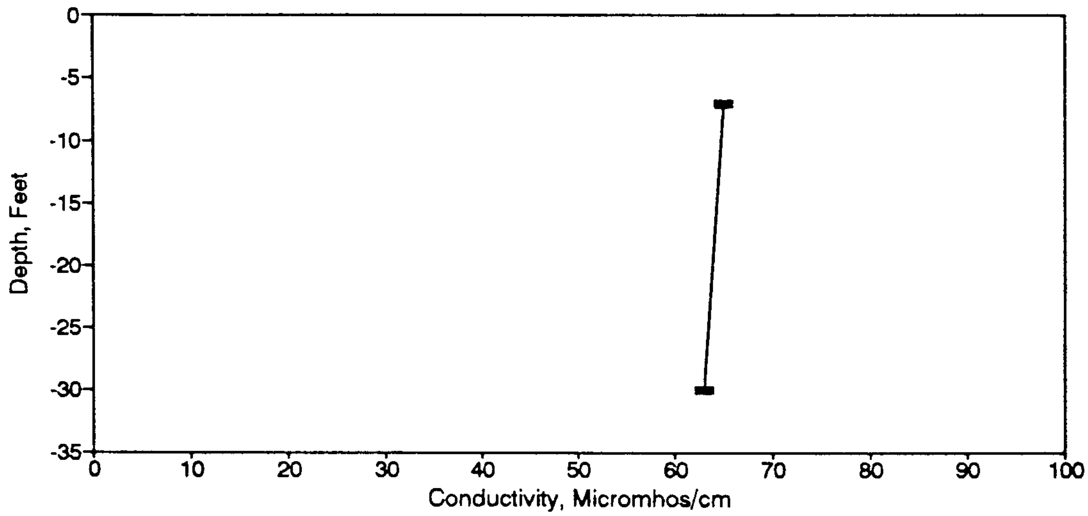

Figure BC102. Conductivity Profile for the Waveland Site-December 13, 1989.

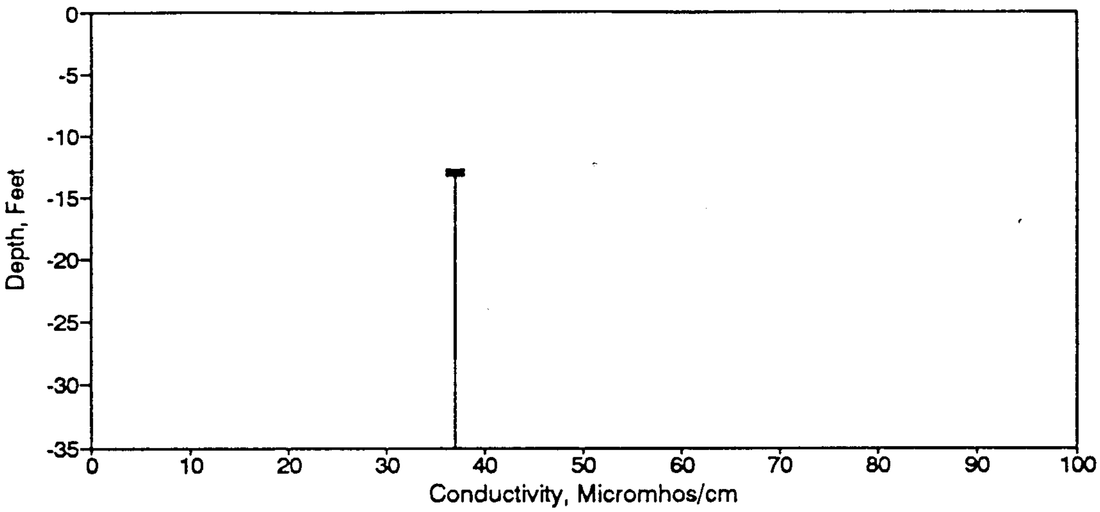

Figure BC103. Conductivity Profile for the Waveland Site-May 24, 1990.

APPENDIX BP

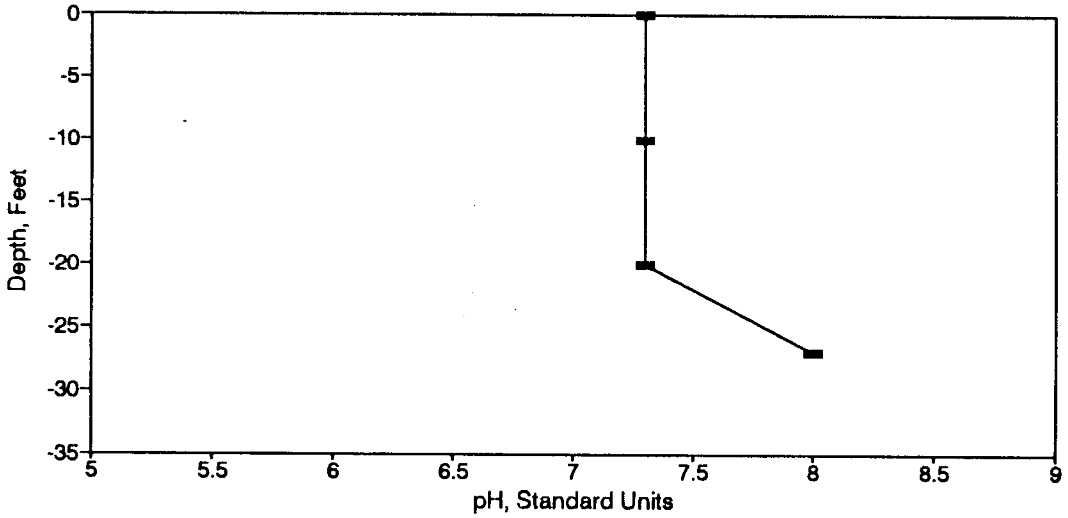

Figure BP1. pH Profile for the Waveland Site-October 15, 1980.

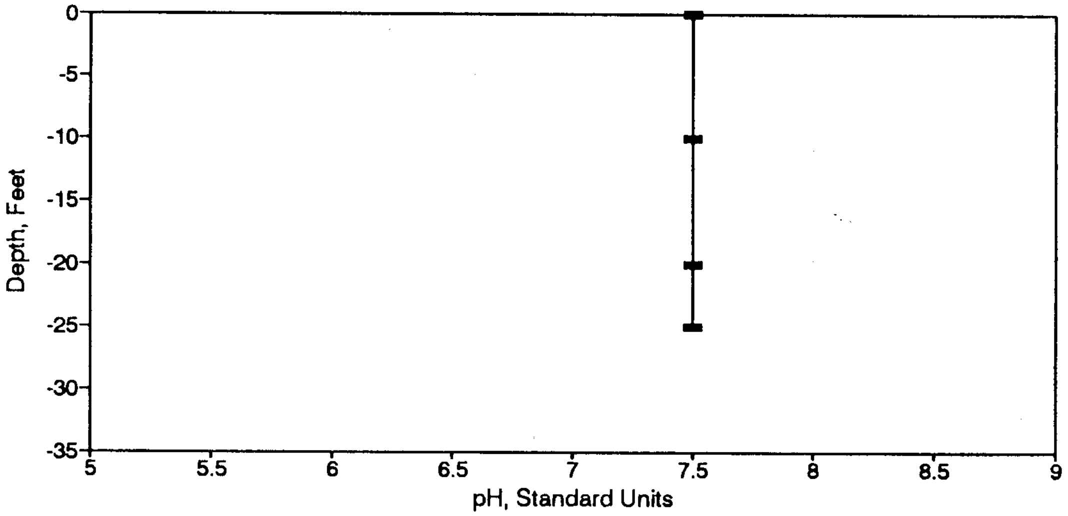

Figure BP2. pH Profile for the Waveland Site-November 18, 1980

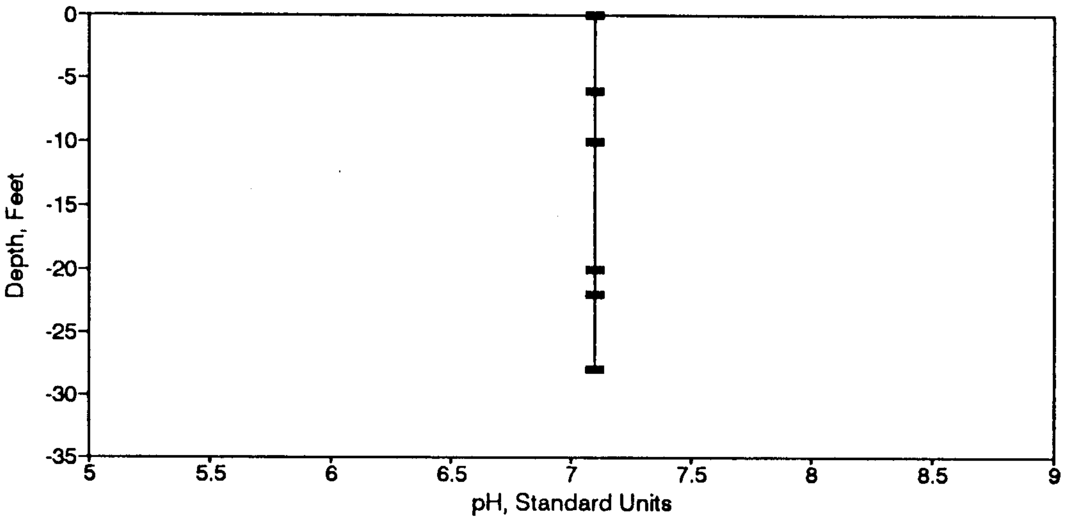

Figure BP3. pH Profile for the Waveland Site-December 9, 1980.

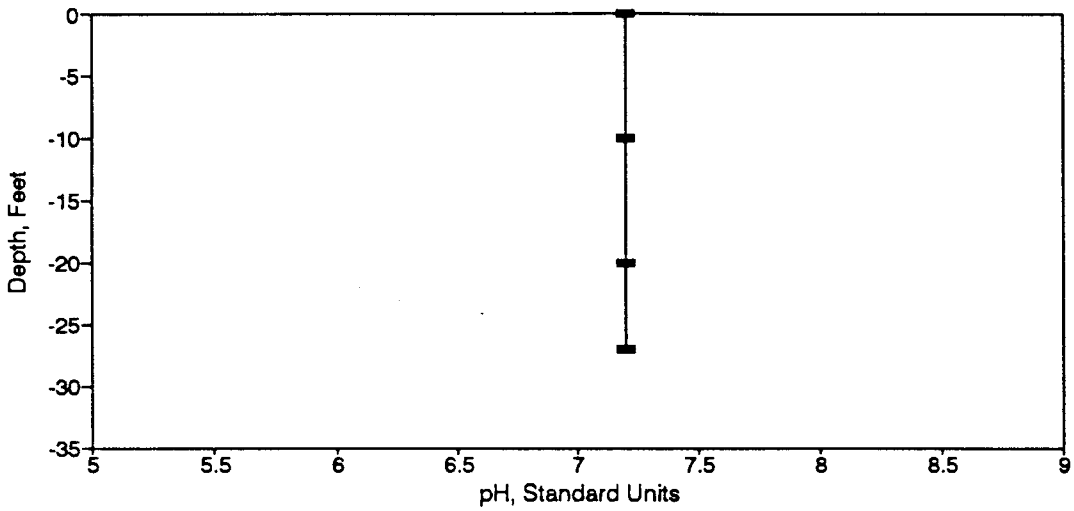

Figure BP4. pH Profile for the Waveland Site-February 2, 1981.

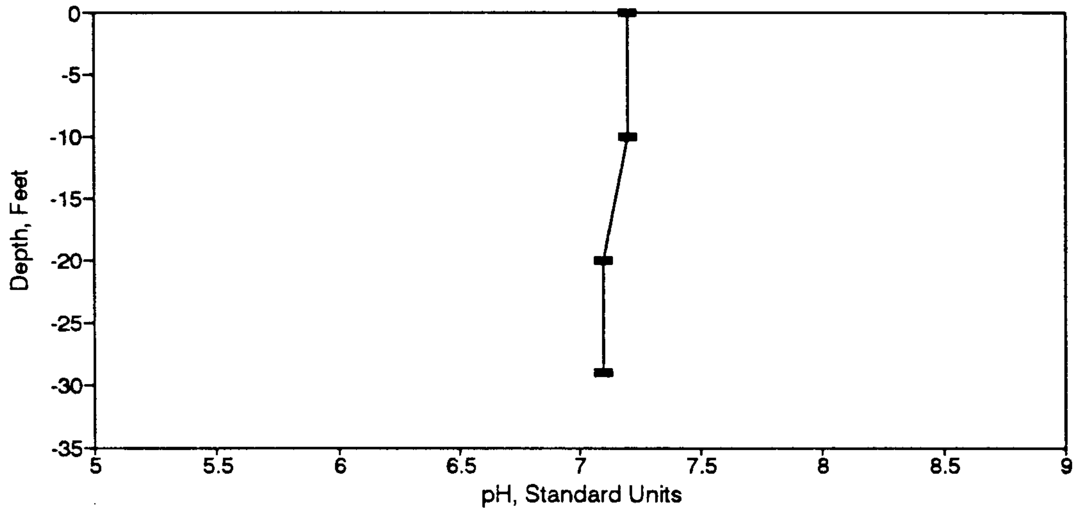

Figure BP5. pH Profile for the Waveland Site-March 3, 1981.

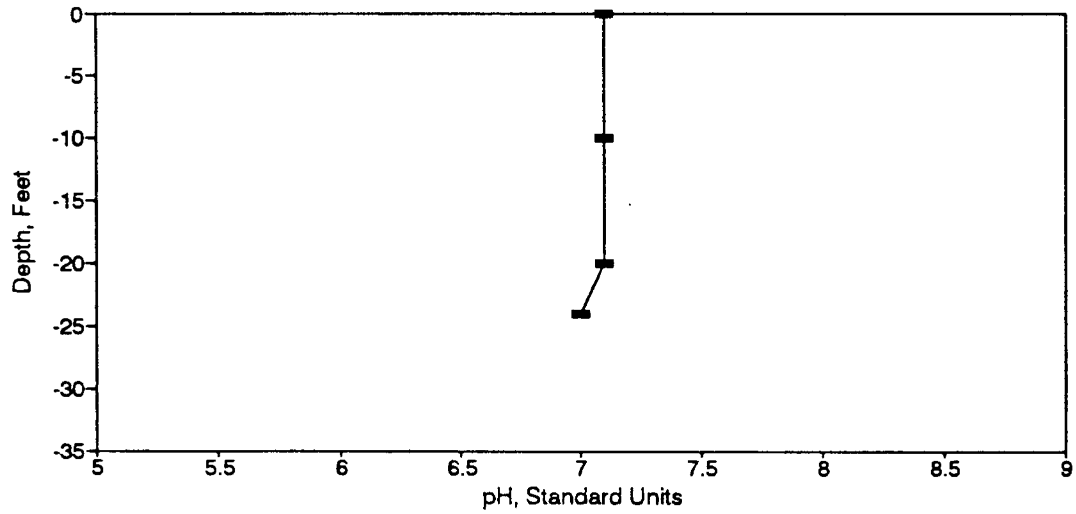

Figure BP6. pH Profile for the Waveland Site-April 7, 1981.

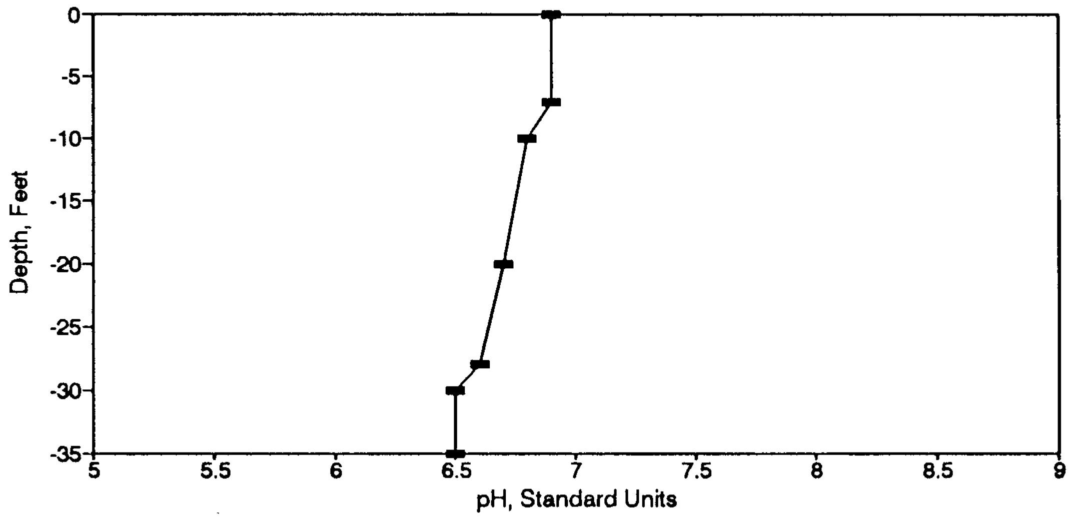

Figure BP7. pH Profile for the Waveland Site-May 12, 1981.

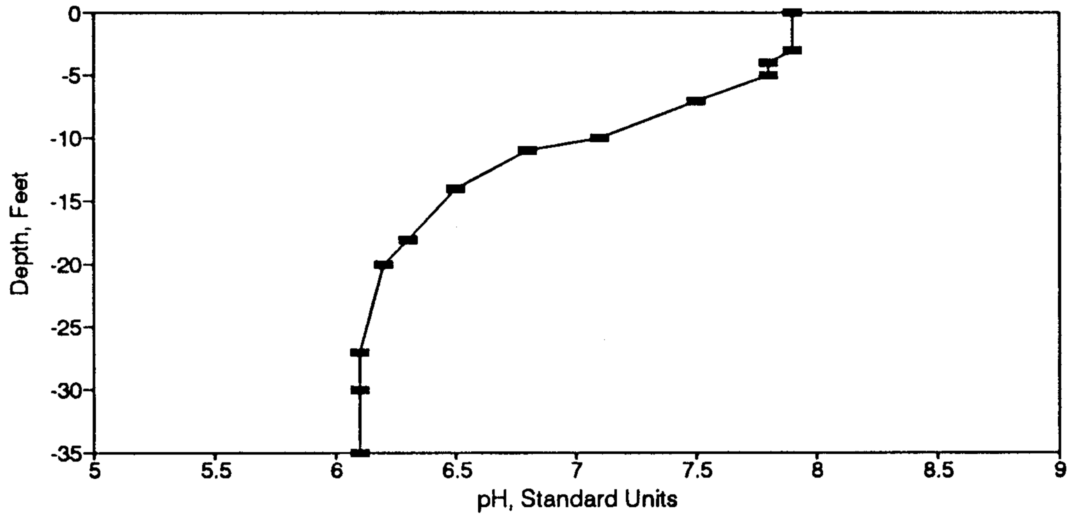

Figure BP8. pH Profile for the Waveland Site-June 9, 1981.

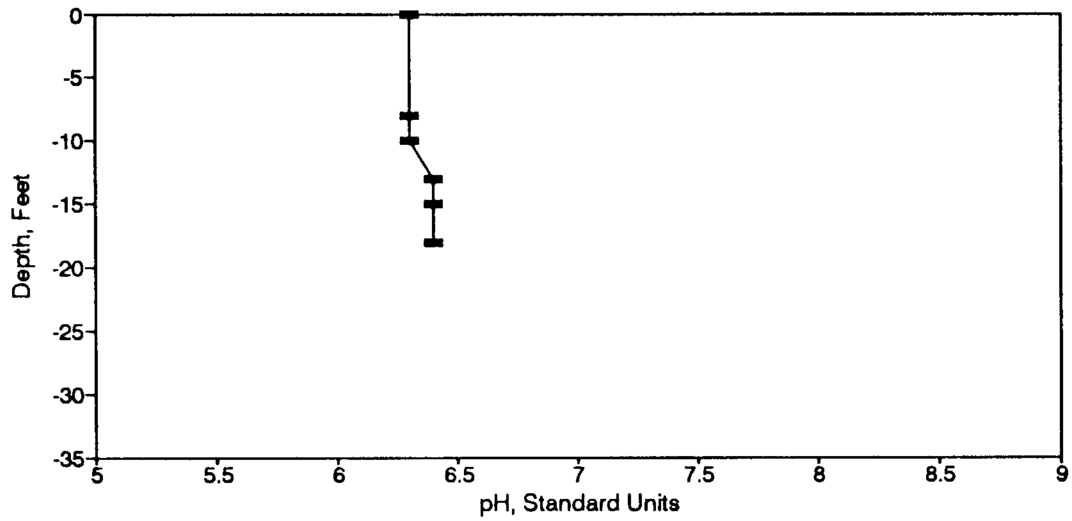

Figure BP9. pH Profile for the Waveland Site-July 7, 1981.

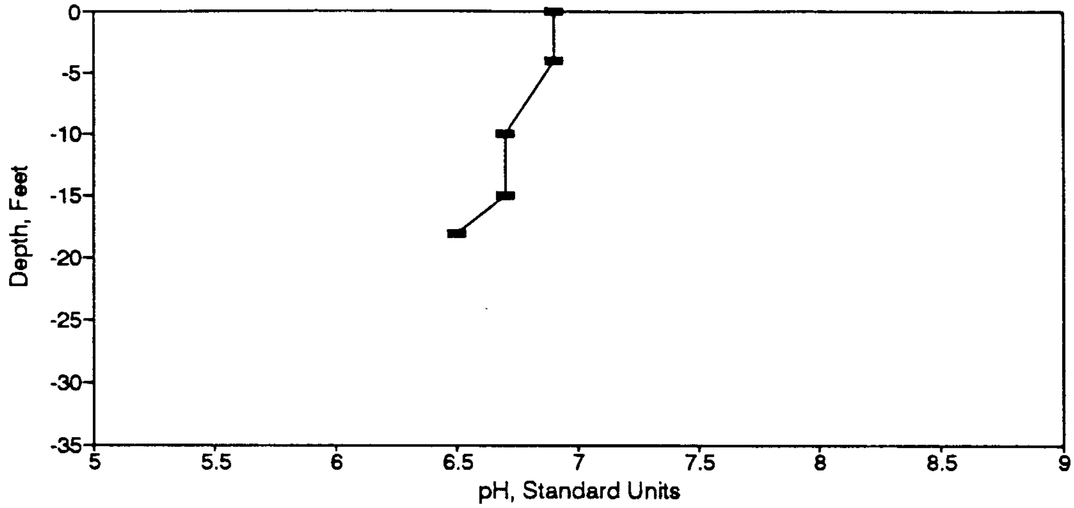

Figure BP10. pH Profile for the Waveland Site-August 11, 1981.

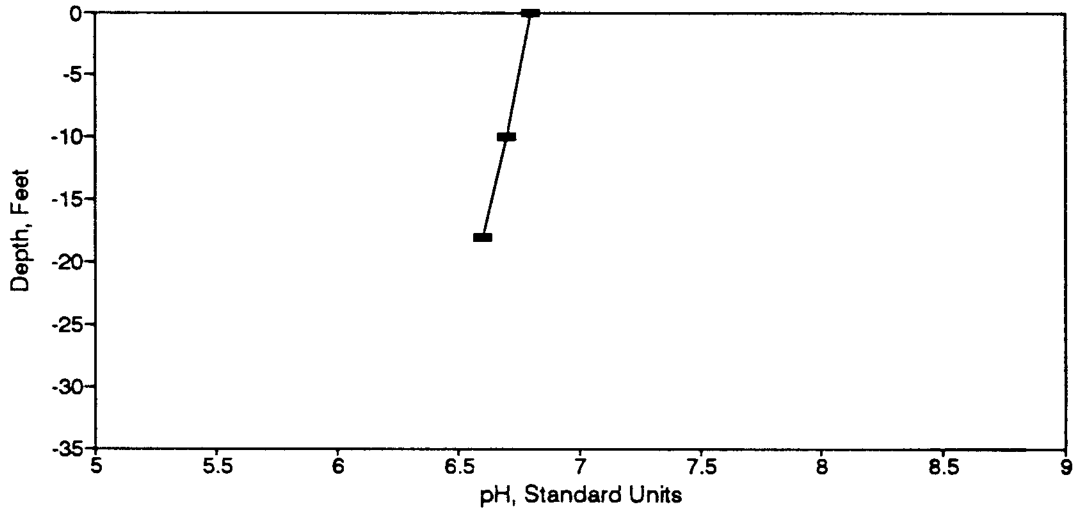

Figure BP11. pH Profile for the Waveland Site-September 9, 1981.

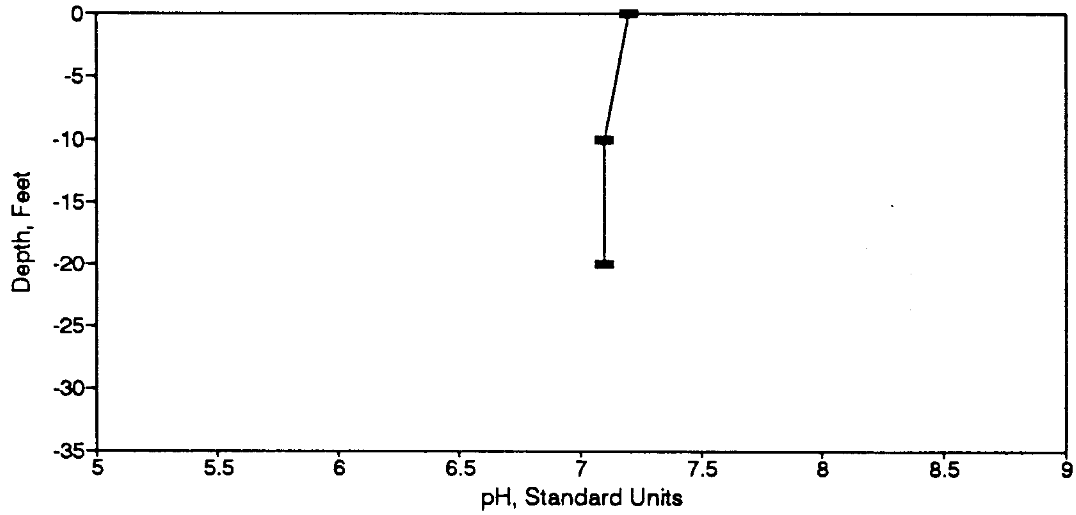

Figure BP12. pH Profile for the Waveland Site-October 13, 1981.

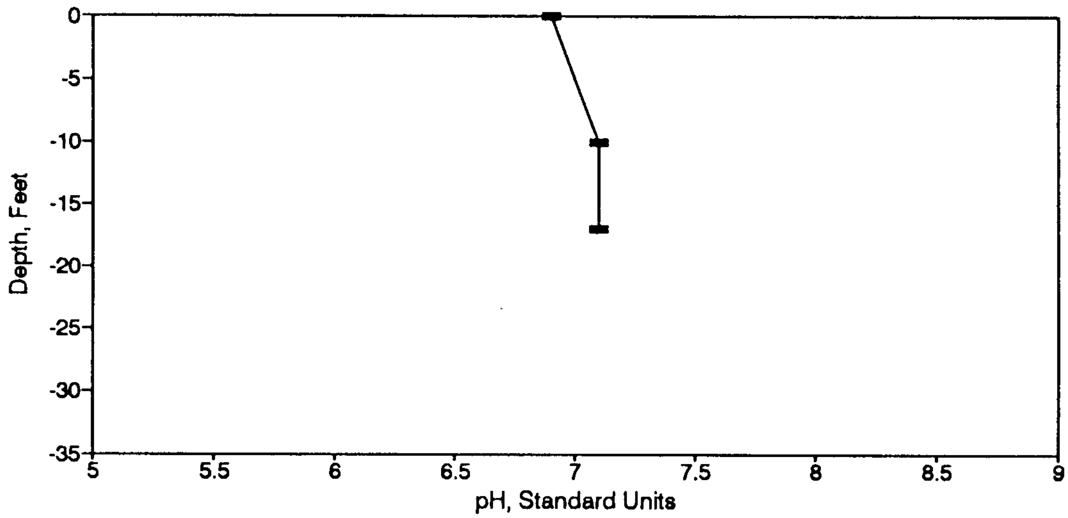

Figure BP13. pH Profile for the Waveland Site-November 19,1981.

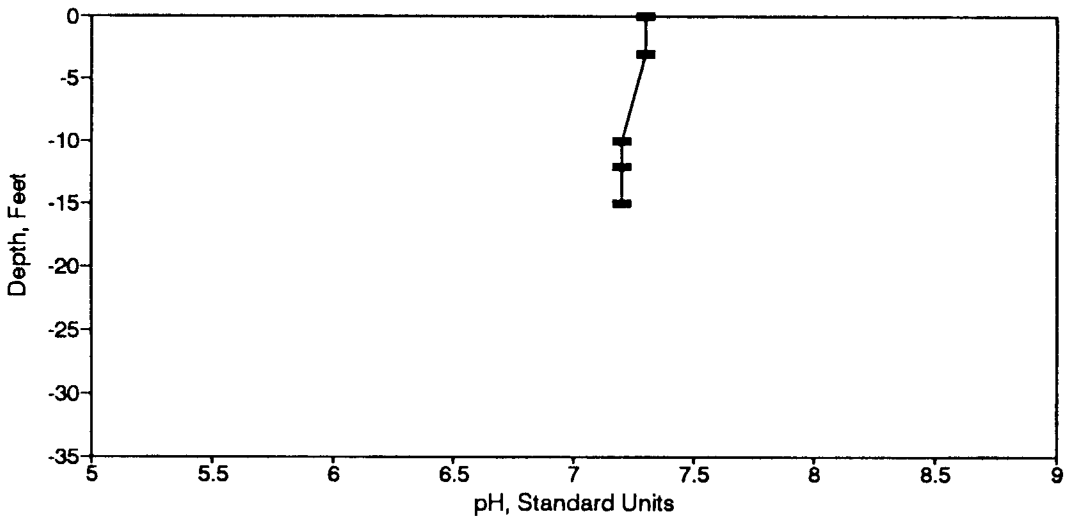

Figure BP14. pH Profile for the Waveland Site-December 8, 1981.

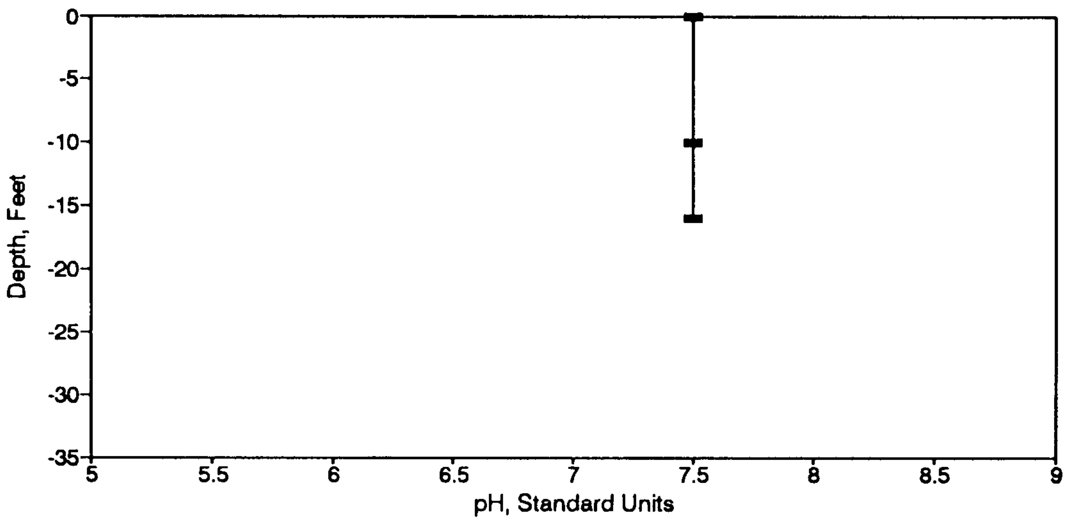

Figure BP15. pH Profile for the Waveland Site-January 15, 1982.

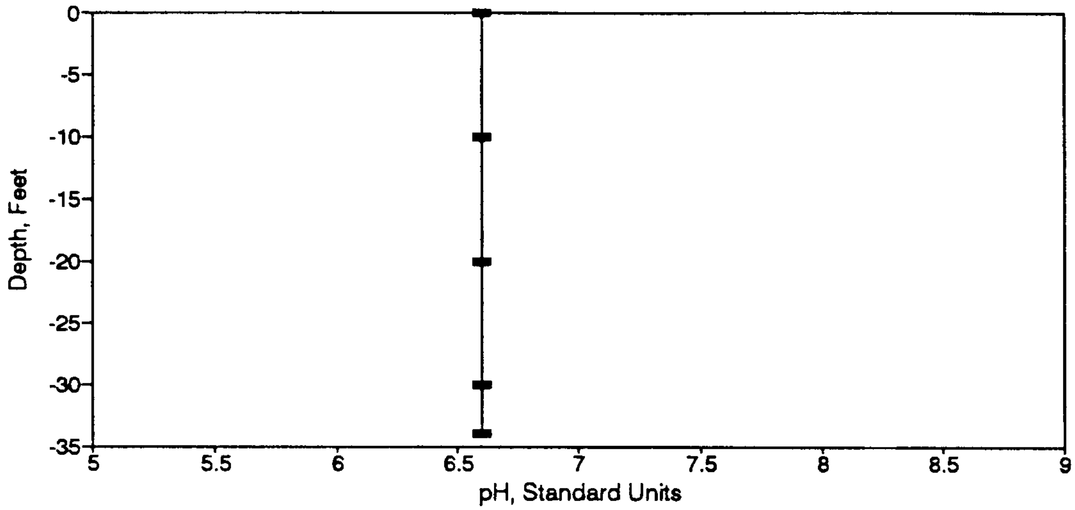

Figure BP16. pH Profile for the Waveland Site-February 12, 1982.

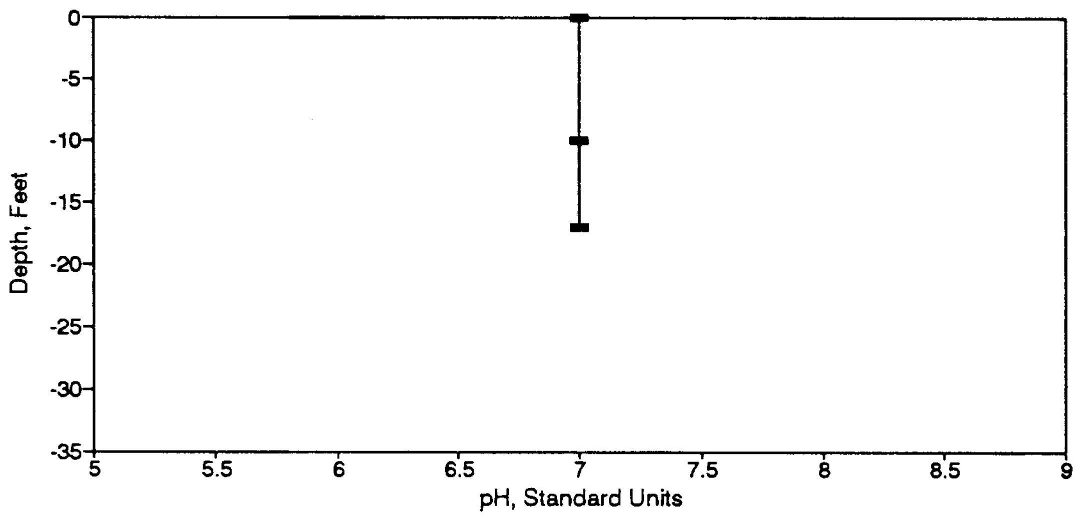

Figure BP17. pH Profile for the Waveland Site-March 15, 1982.

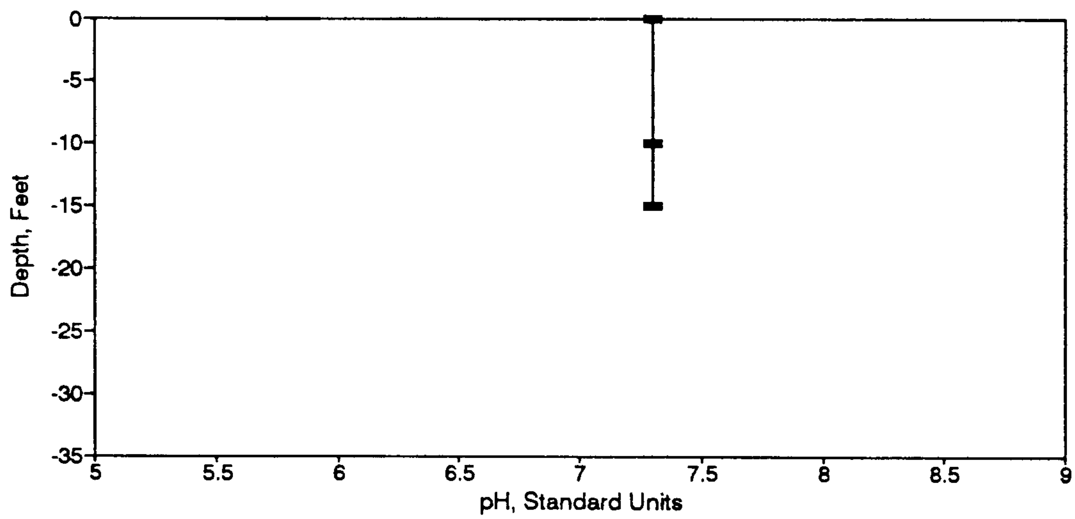

Figure BP18. pH Profile for the Waveland Site-April 2, 1982.

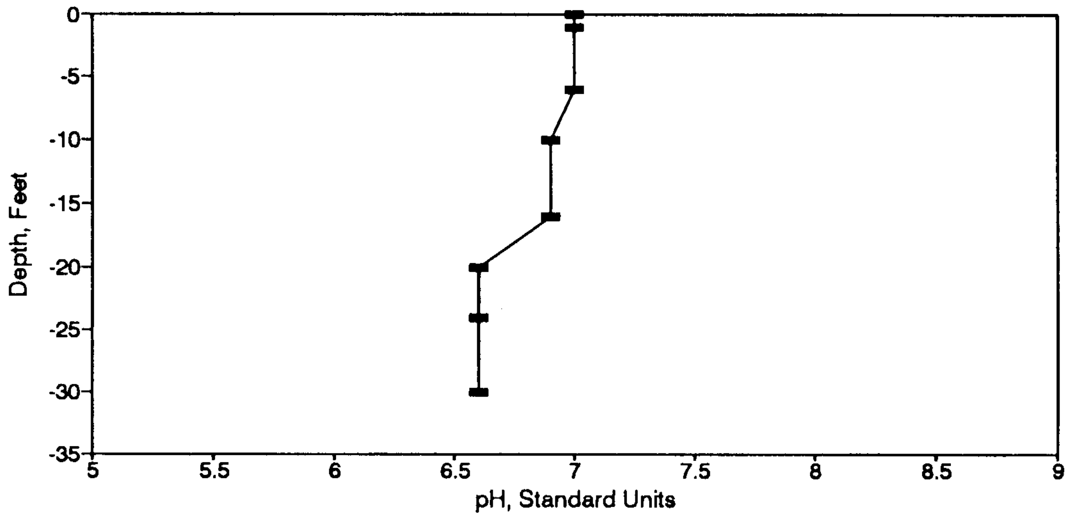

Figure BP19. pH Profile for the Waveland Site-May 17, 1982.

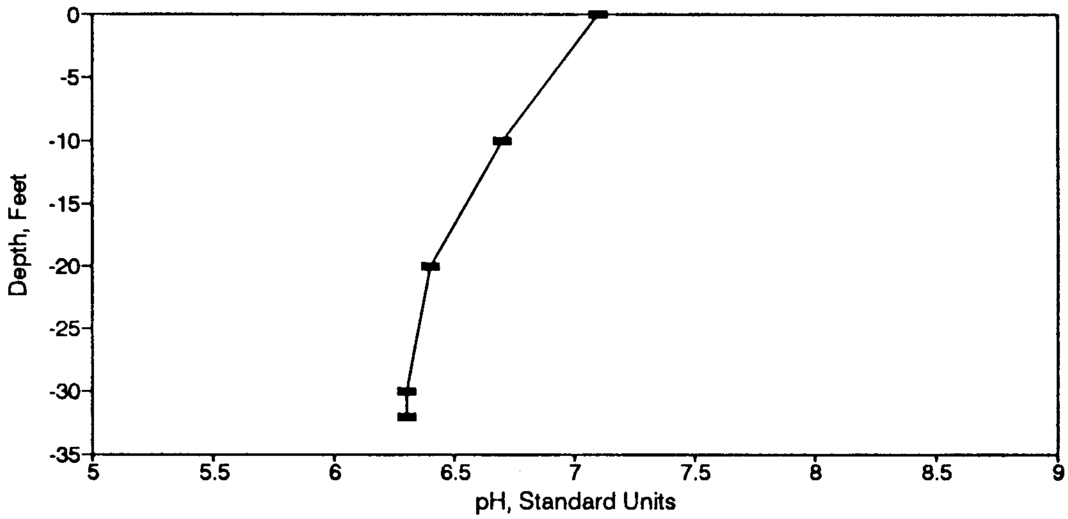

Figure BP20. pH Profile for the Waveland Site-June 18, 1982.

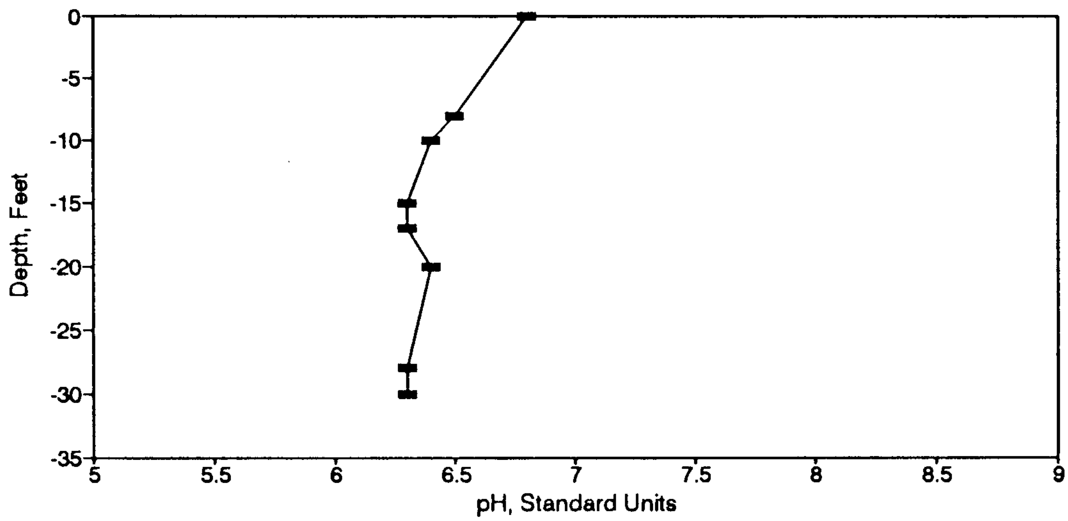

Figure BP21. pH Profile for the Waveland Site-July 12, 1982.

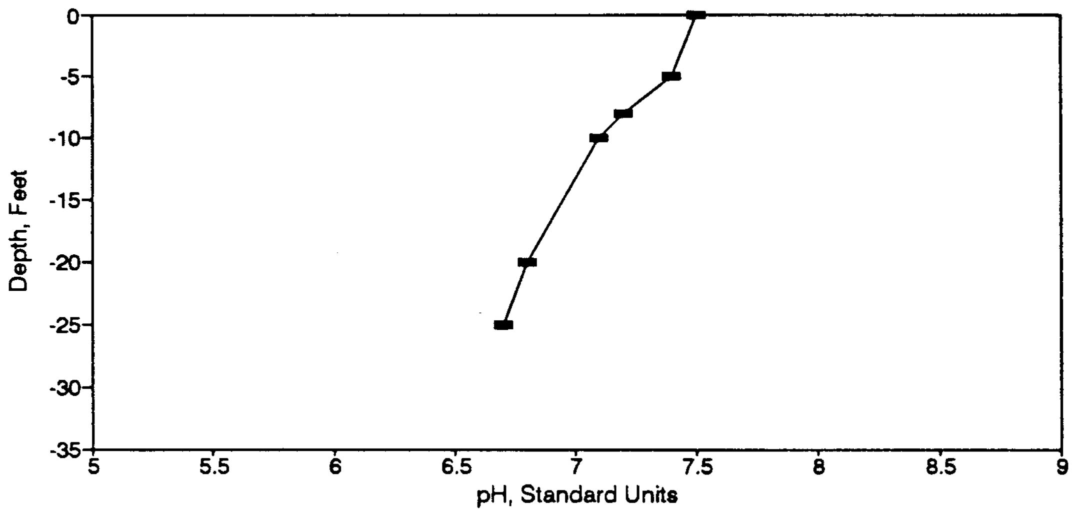

Figure BP22. pH Profile for the Waveland Site-August 16, 1982.

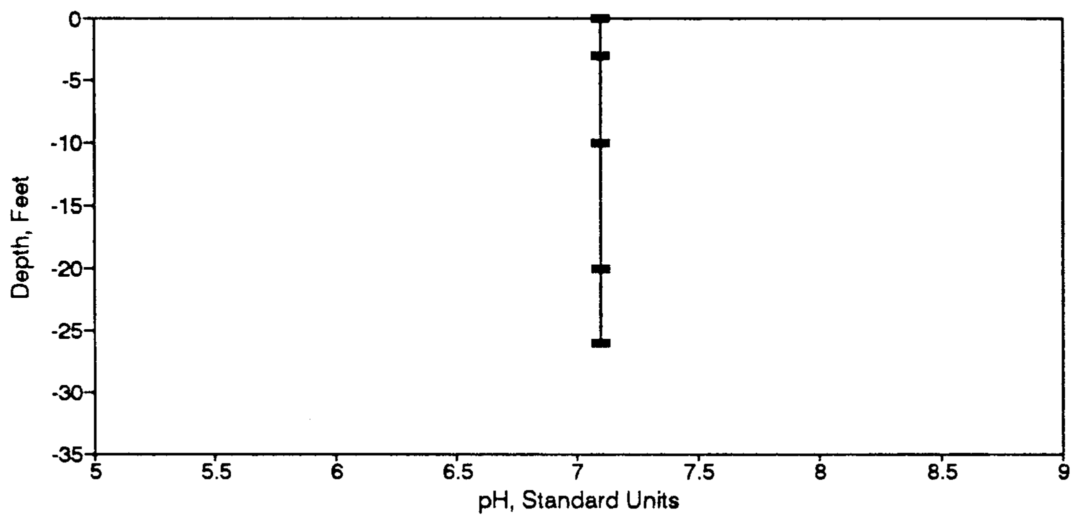

Figure BP23. pH Profile for the Waveland Site-September 29, 1982.

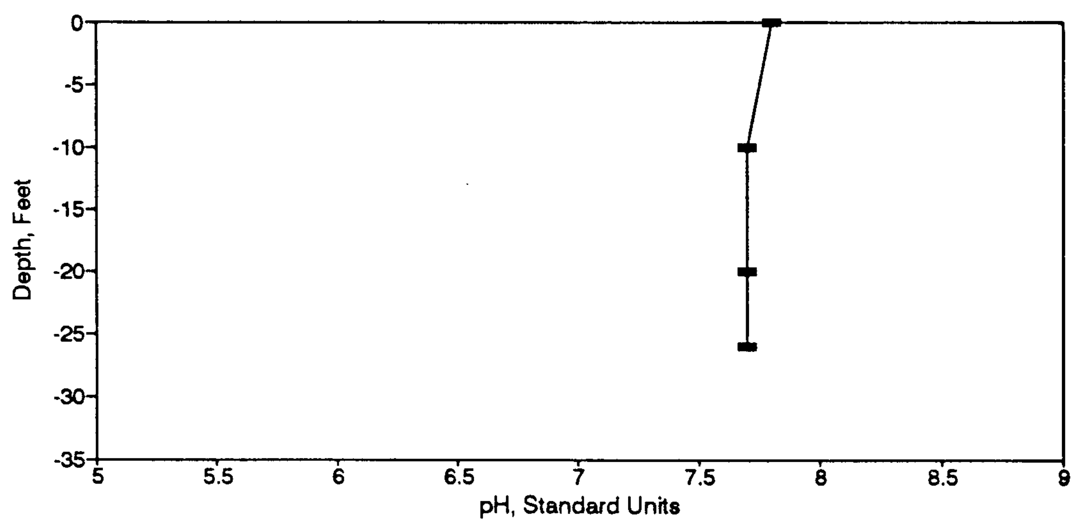

Figure BP24. pH Profile for the Waveland Site-October 15, 1982.

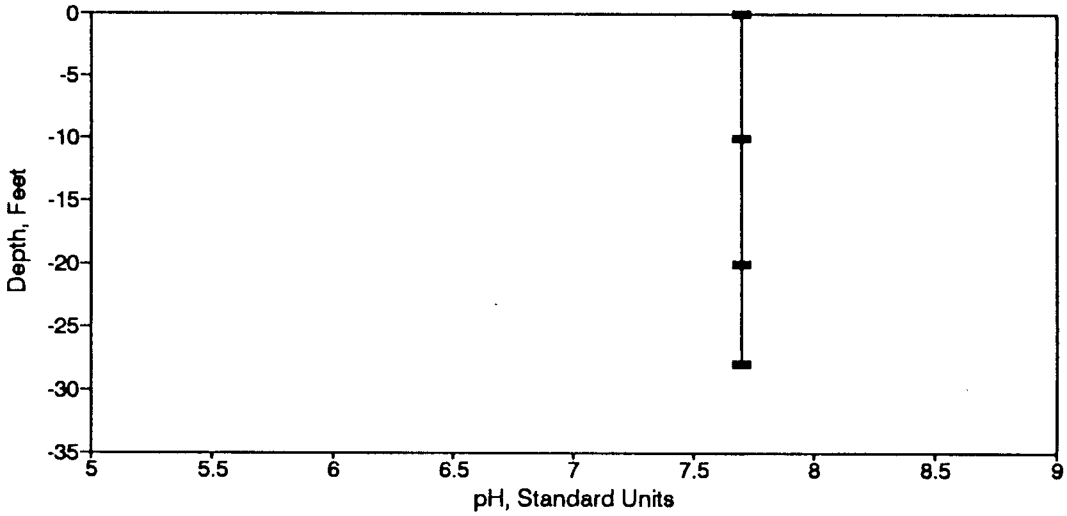

Figure BP25. pH Profile for the Waveland Site-November 16, 1982.

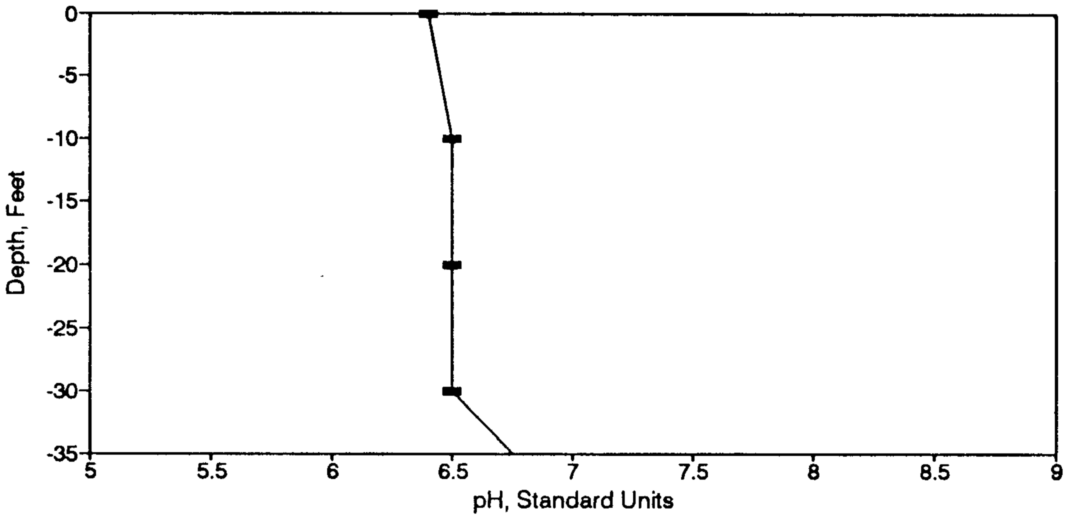

Figure BP26. pH Profile for the Waveland Site-December 20, 1982.

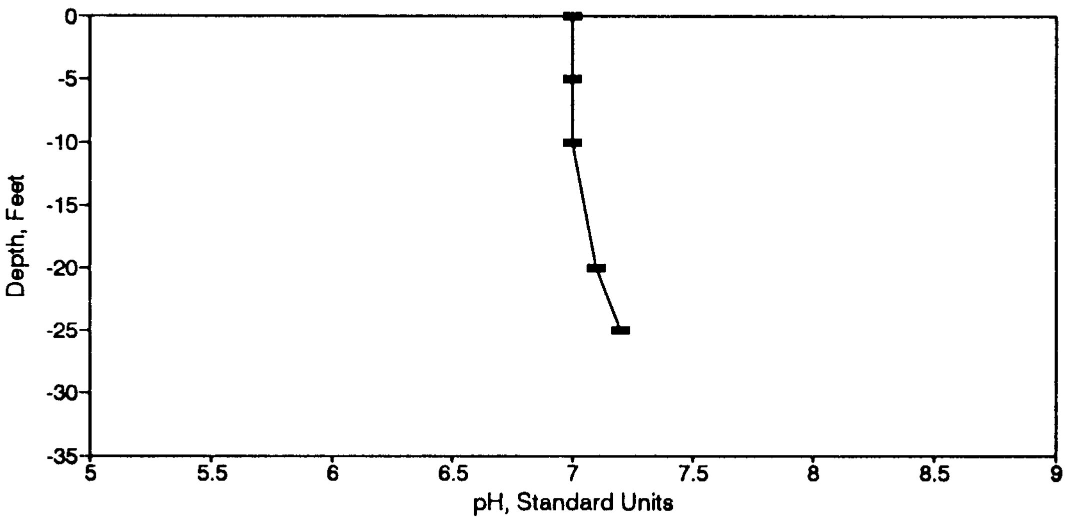

Figure BP27. pH Profile for the Waveland Site-January 26, 1983.

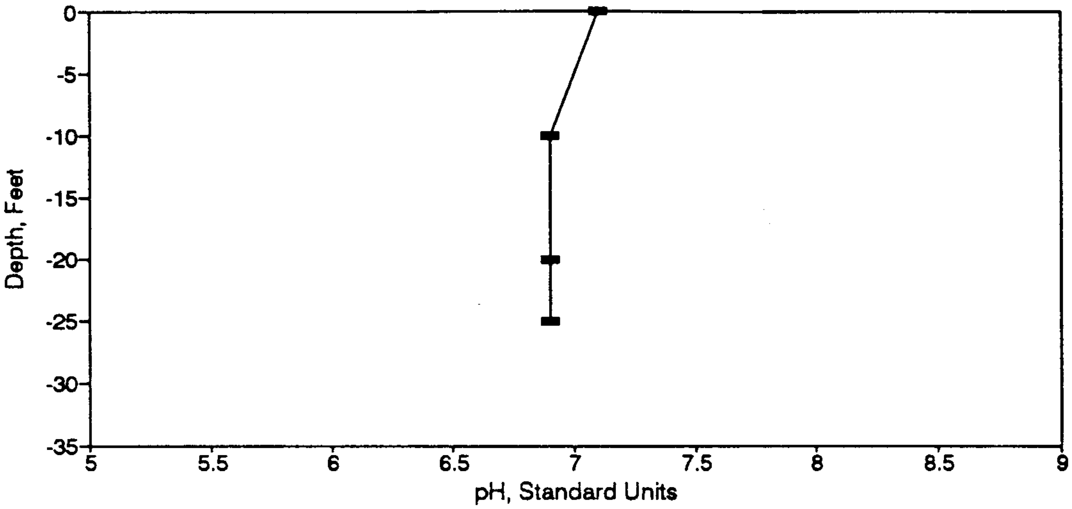

Figure BP28. pH Profile for the Waveland Site-February 18, 1983.

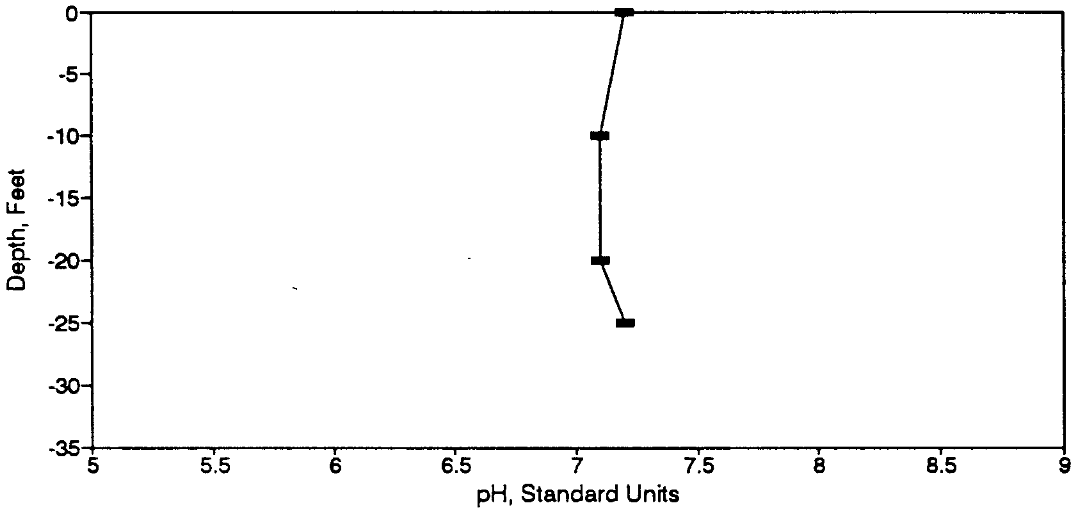

Figure BP29. pH Profile for the Waveland Site-March 25, 1983.

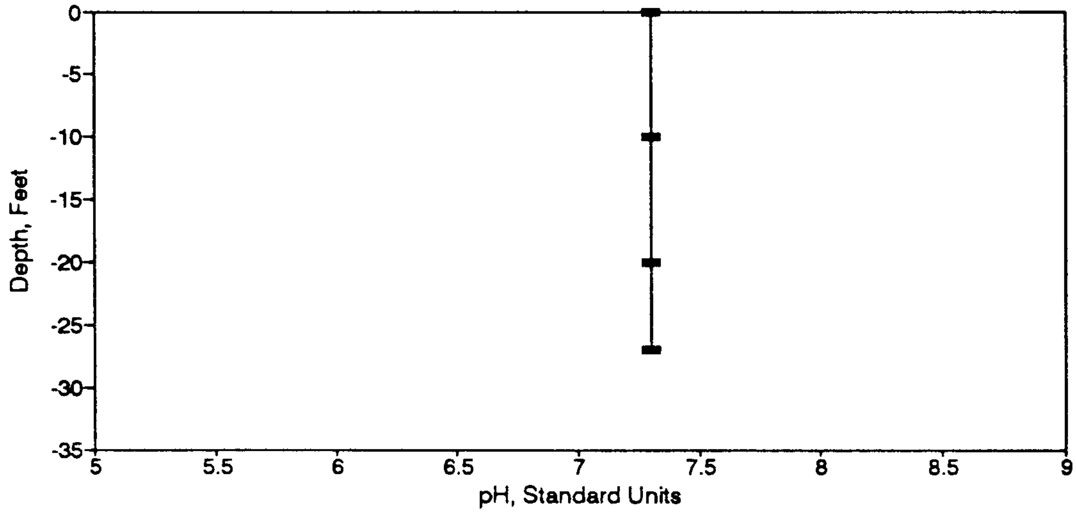

Figure BP30. pH Profile for the Waveland Site-April 18, 1983.

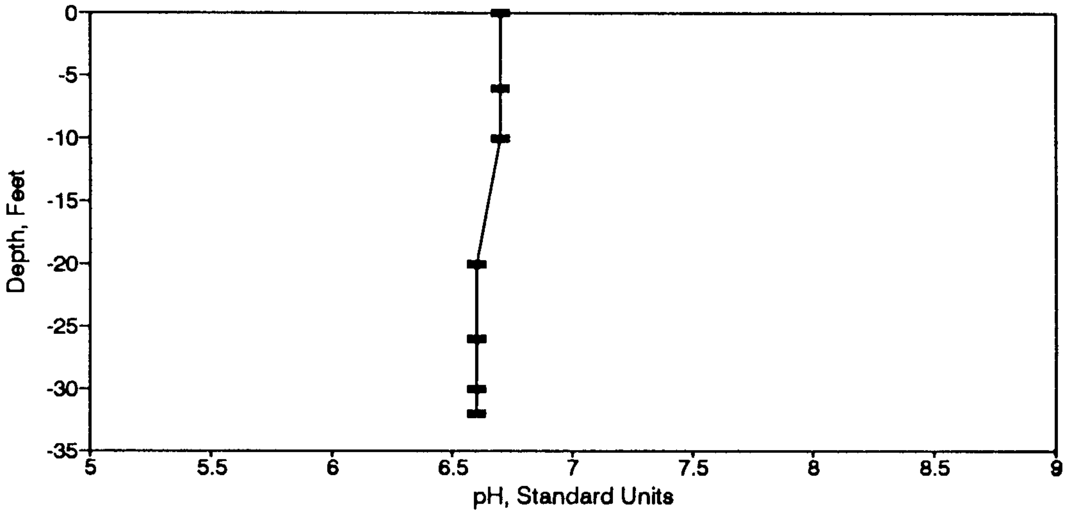

Figure BP31. pH Profile for the Waveland Site-May 16, 1983.

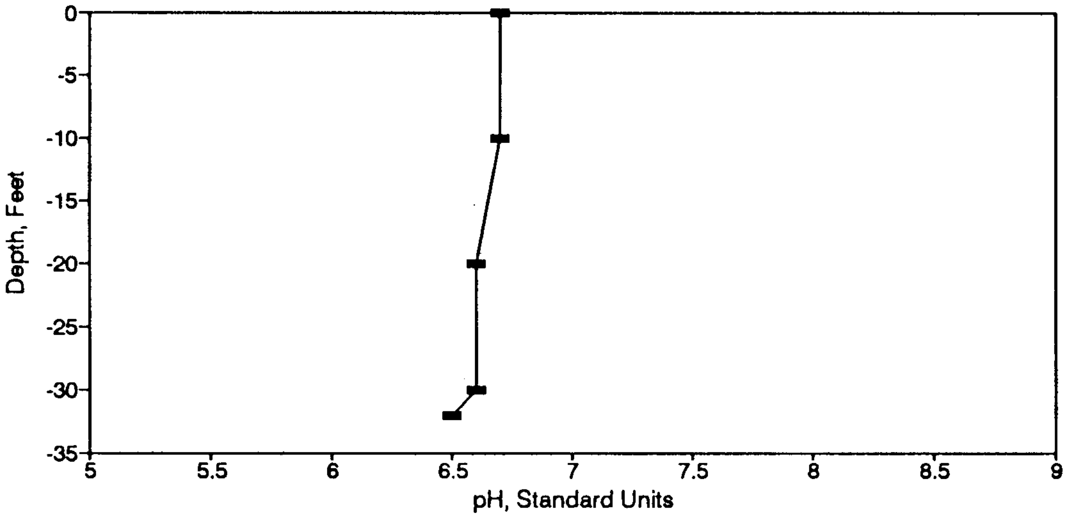

Figure BP32. pH Profile for the Waveland Site-June 9, 1983.

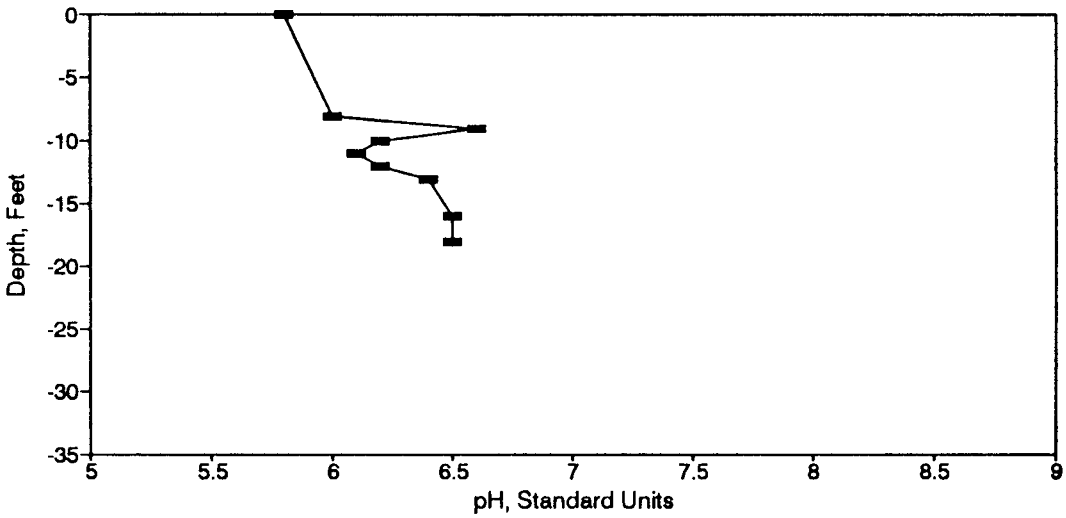

Figure BP33. pH Profile for the Waveland Site-July 22, 1983.

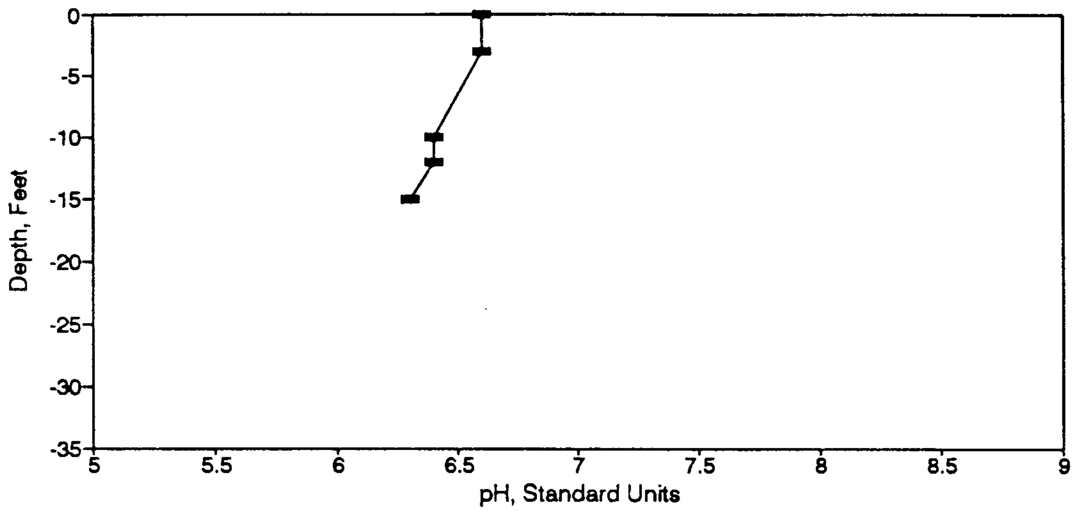

Figure BP34. pH Profile for the Waveland Site-August 15, 1983.

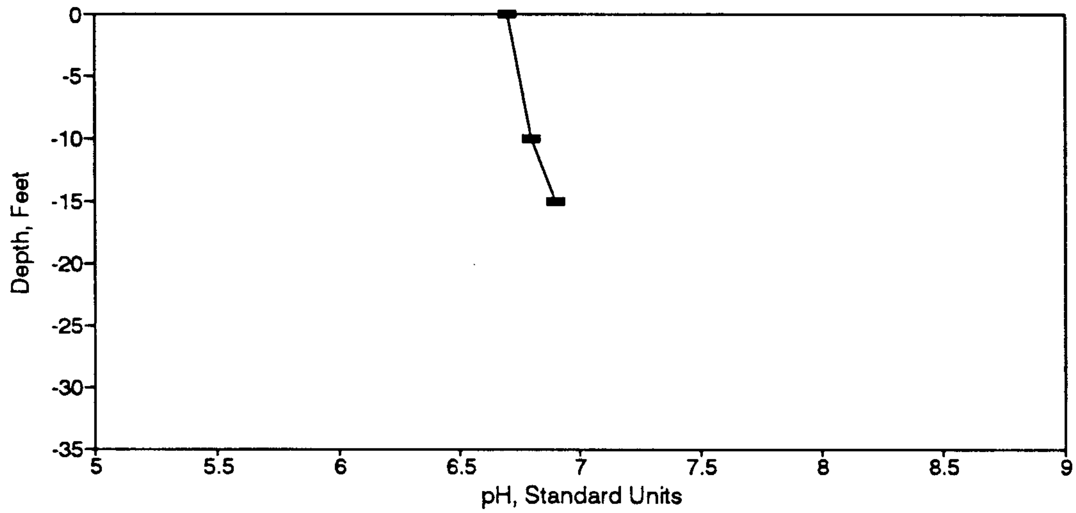

Figure BP35. pH Profile for the Waveland Site-September 14, 1983.

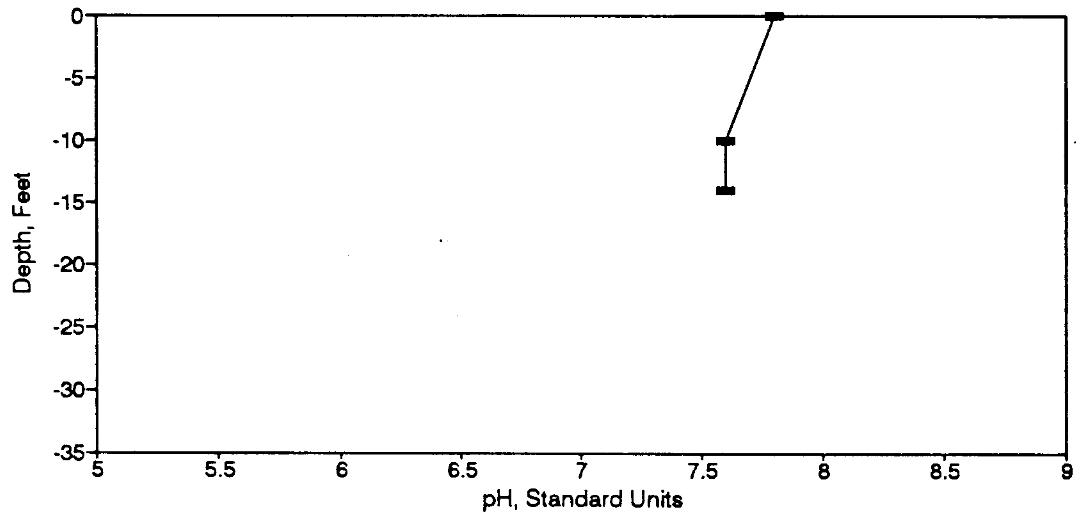

Figure BP36. pH Profile for the Waveland Site-October 14, 1983.

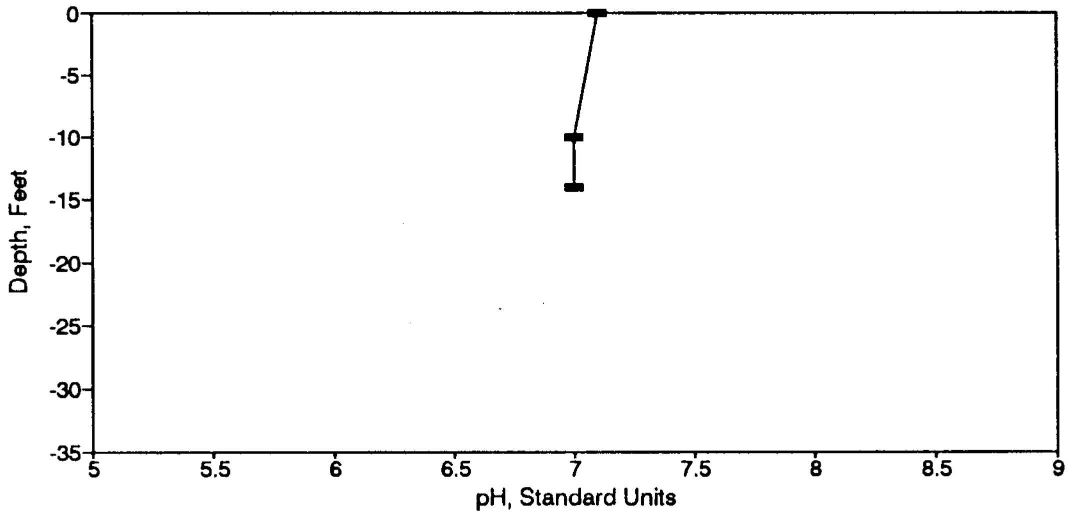

Figure BP37. pH Profile for the Waveland Site-November 1, 1983.

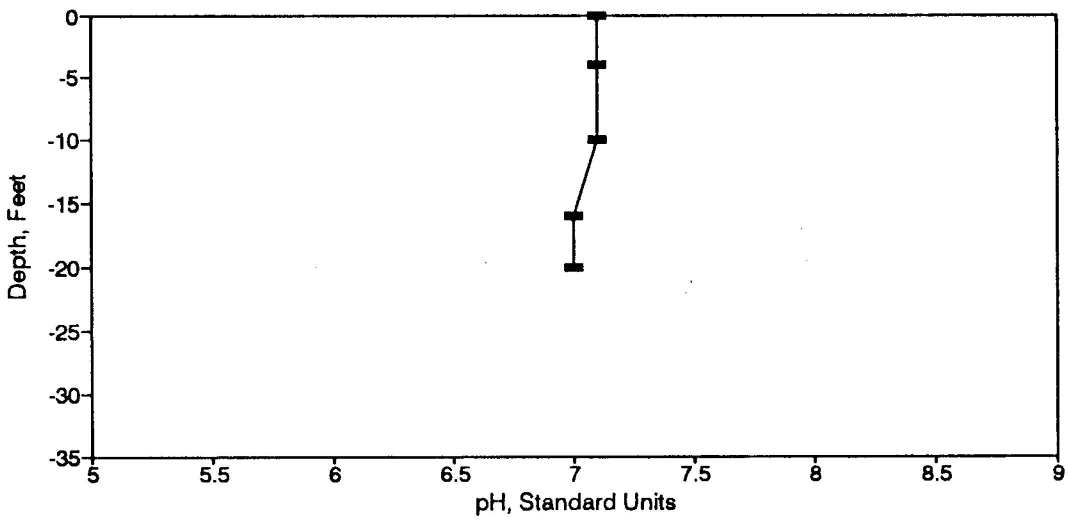

Figure BP38. pH Profile for the Waveland Site-December 5, 1983.

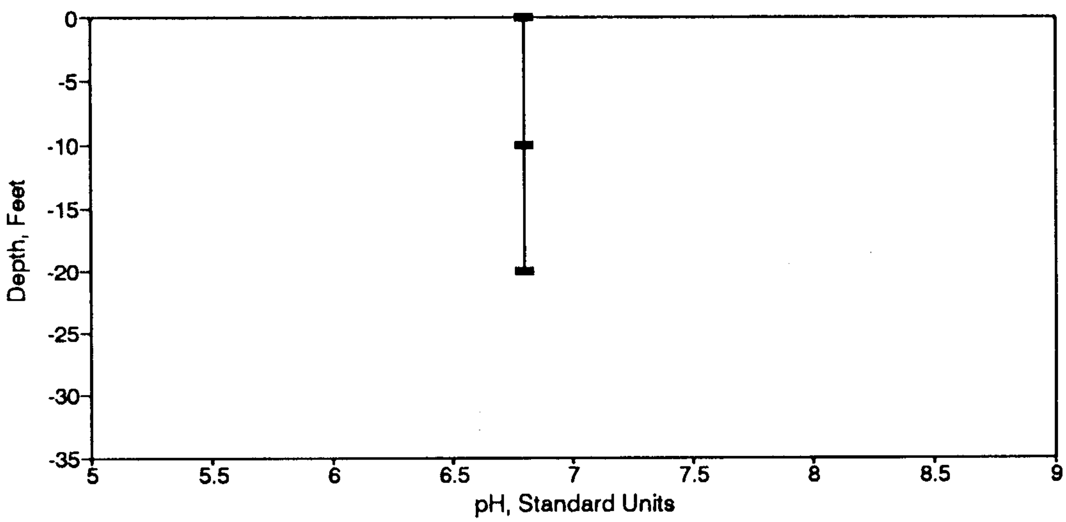

Figure BP39. pH Profile for the Waveland Site-January 12, 1984.

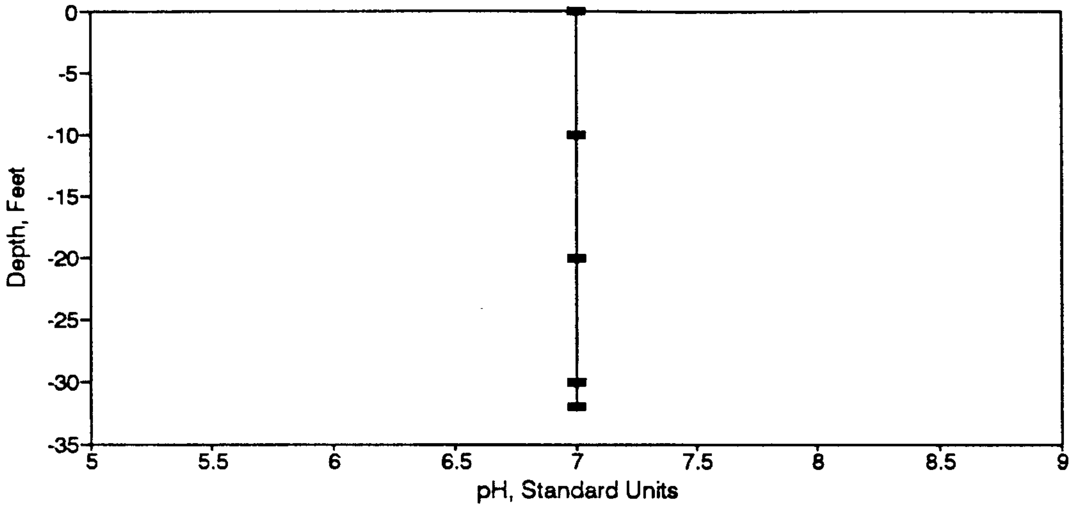

Figure BP40. pH Profile for the Waveland Site-February 6, 1984.

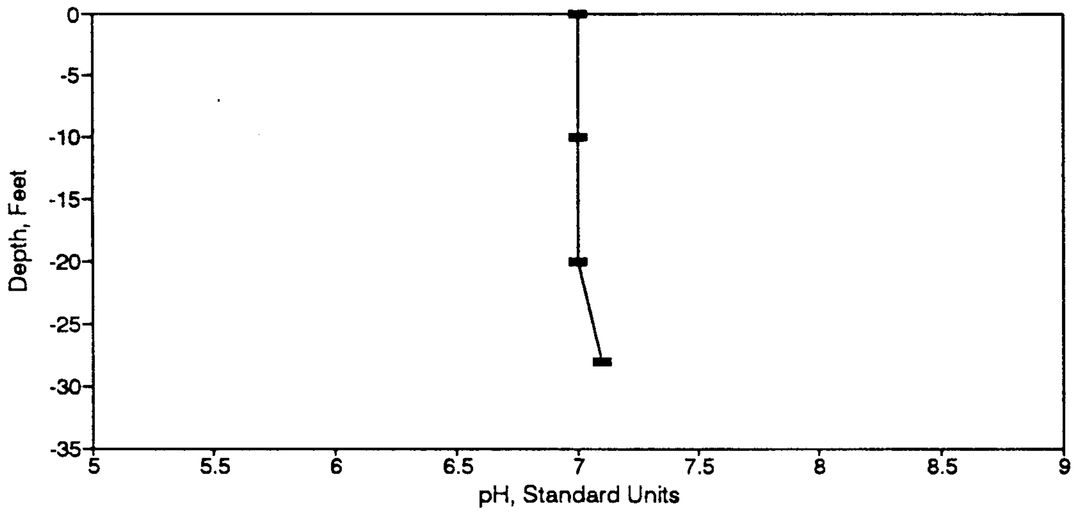

Figure BP41. pH Profile for the Waveland Site-March 19, 1984.

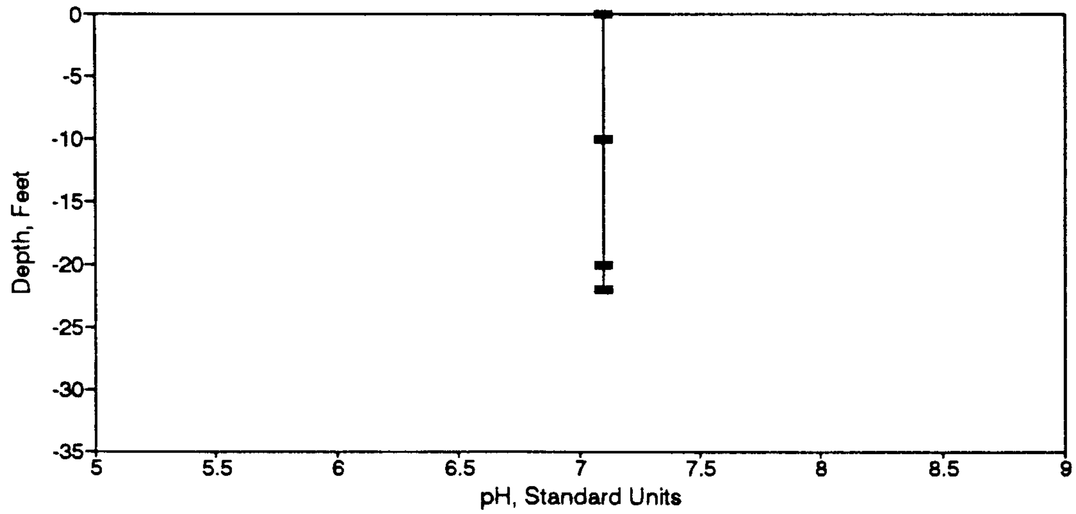

Figure BP42. pH Profile for the Waveland Site-April 9, 1984.

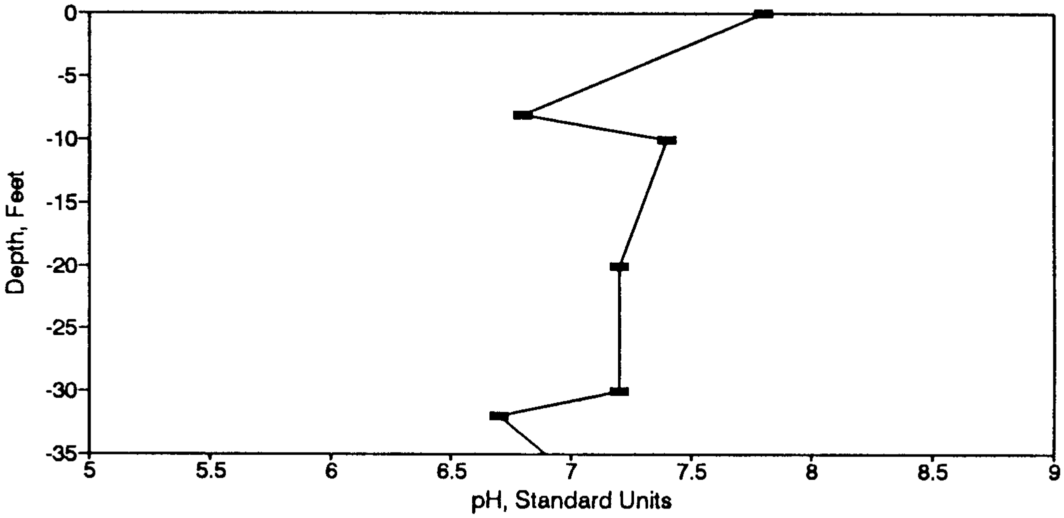

Figure BP43. pH Profile for the Waveland Site-May 8, 1984.

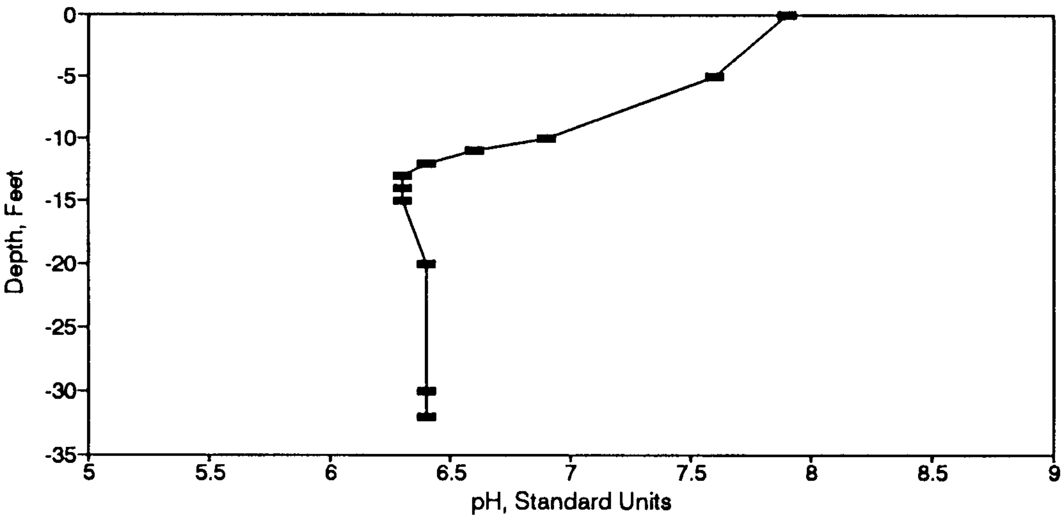

Figure BP44. pH Profile for the Waveland Site-June 18, 1984.

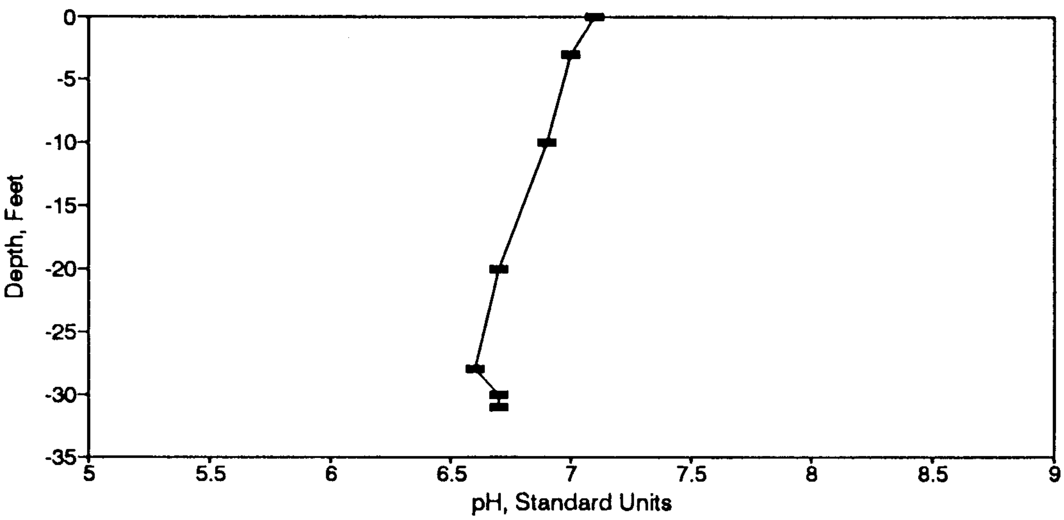

Figure BP45. pH Profile for the Waveland Site-July 23, 1984.

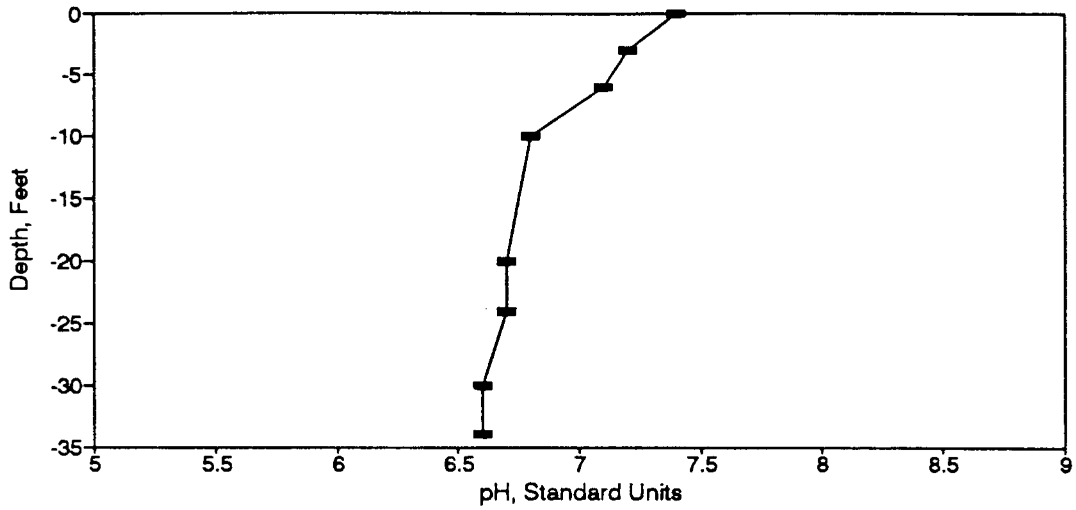

Figure BP46. pH Profile for the Waveland Site-August 27, 1984.

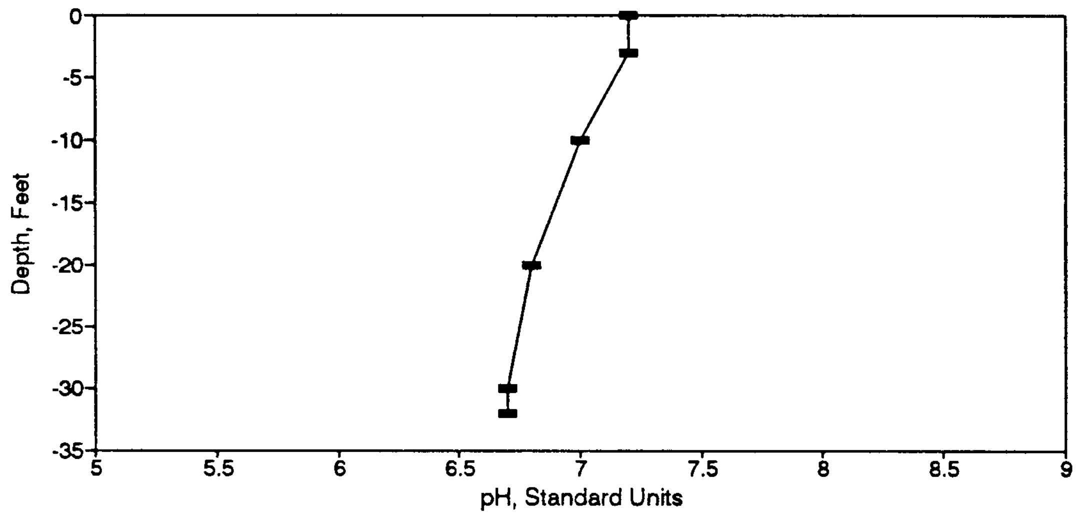

Figure BP47. pH Profile for the Waveland Site-September 24, 1984.

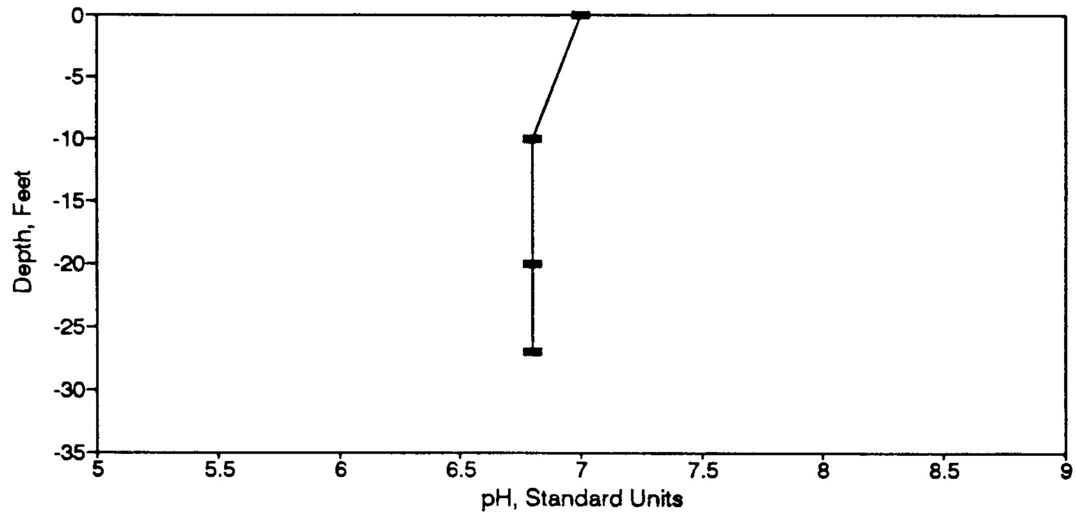

Figure BP48. pH Profile for the Waveland Site-October 11, 1984.

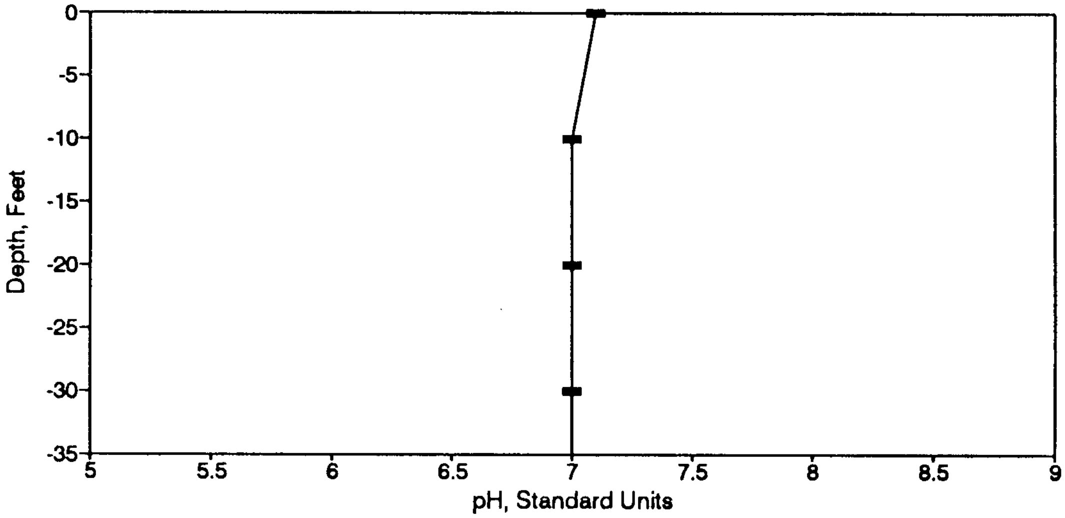

Figure BP49. pH Profile for the Waveland Site-November 21, 1984.

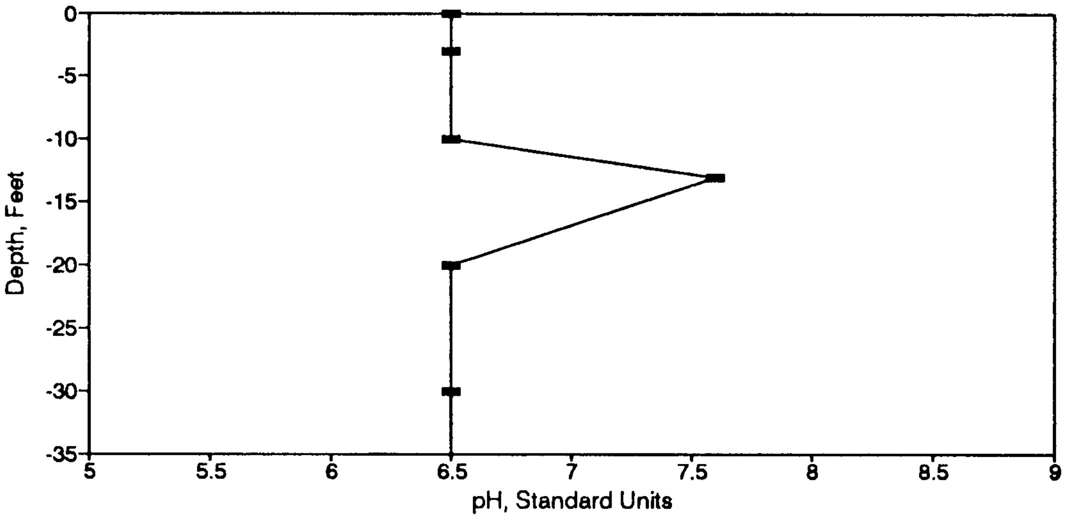

Figure BP50. pH Profile for the Waveland Site-December 20, 1984.

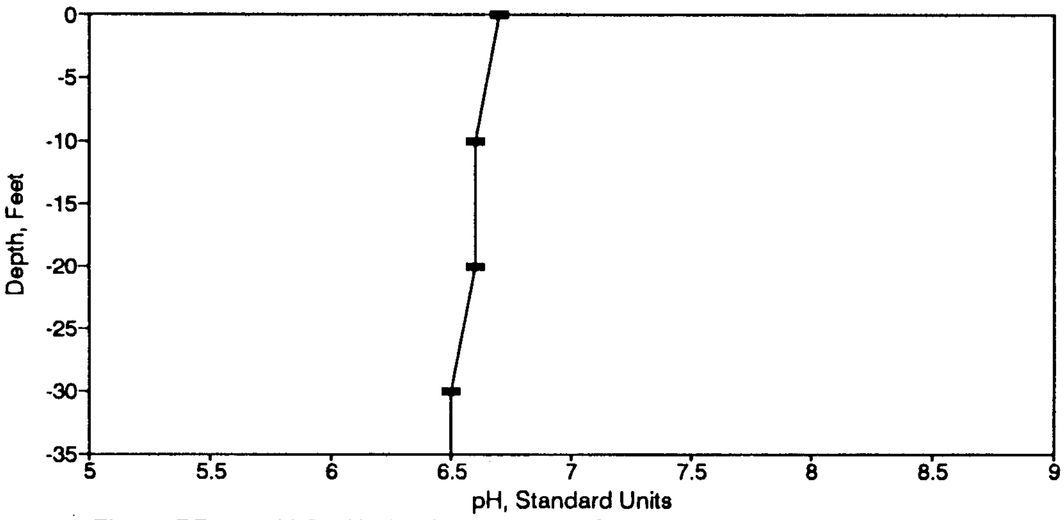

Figure BP51. pH Profile for the Waveland Site-February 26, 1985.

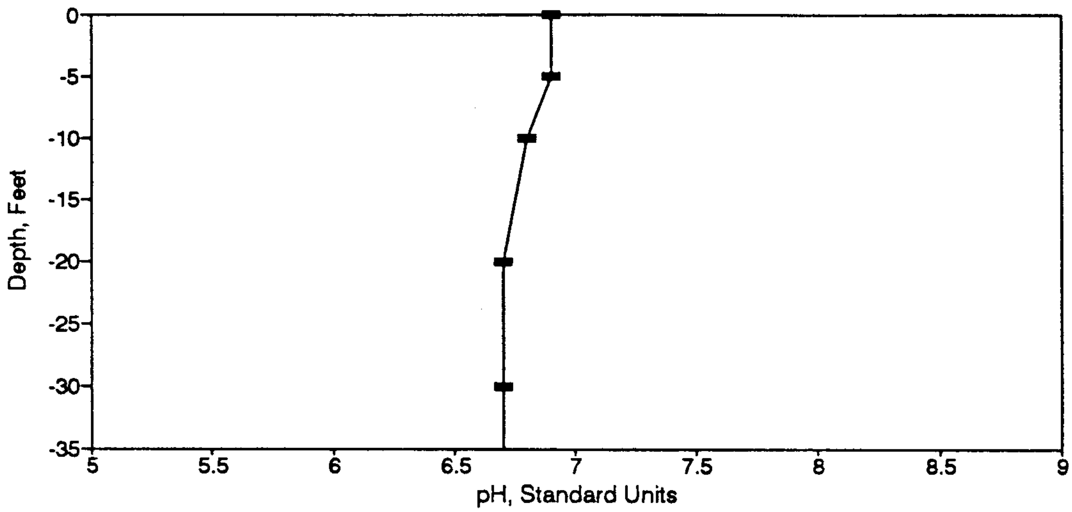

Figure BP52. pH Profile for the Waveland Site-March 19, 1985.

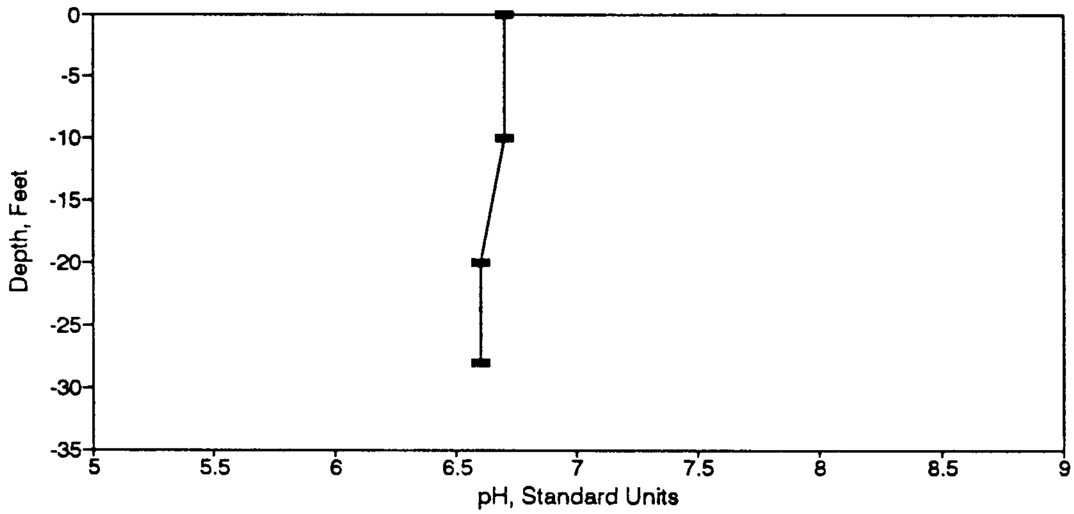

Figure BP53. pH Profile for the Waveland Site-April 23, 1985.

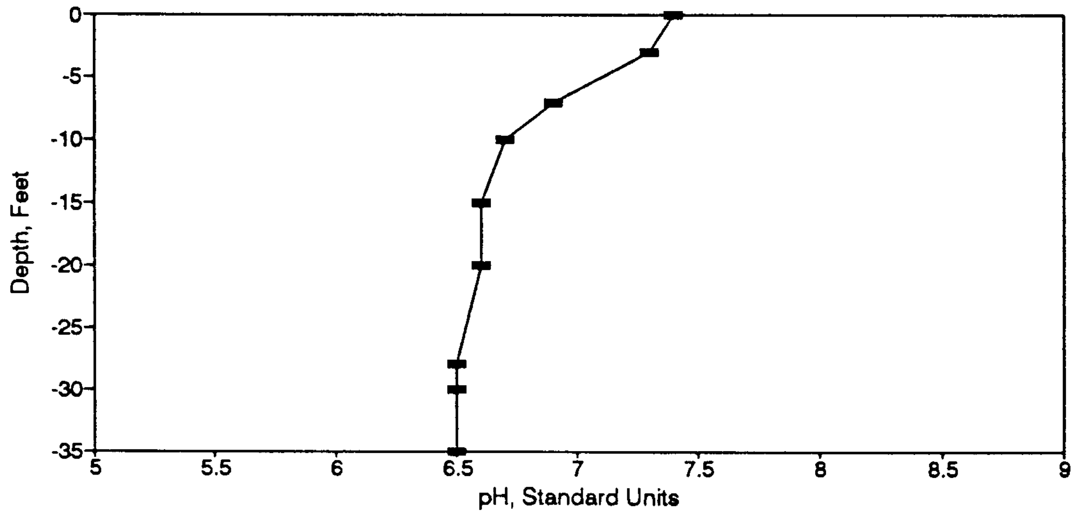

Figure BP54. pH Profile for the Waveland Site-May 28, 1985.

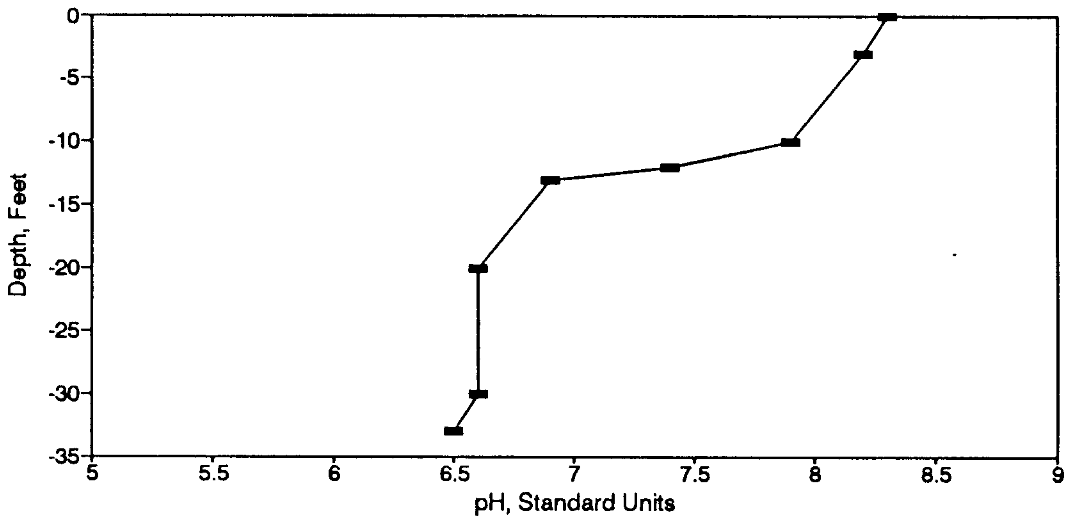

Figure BP55. pH Profile for the Waveland Site-June 17, 1985.

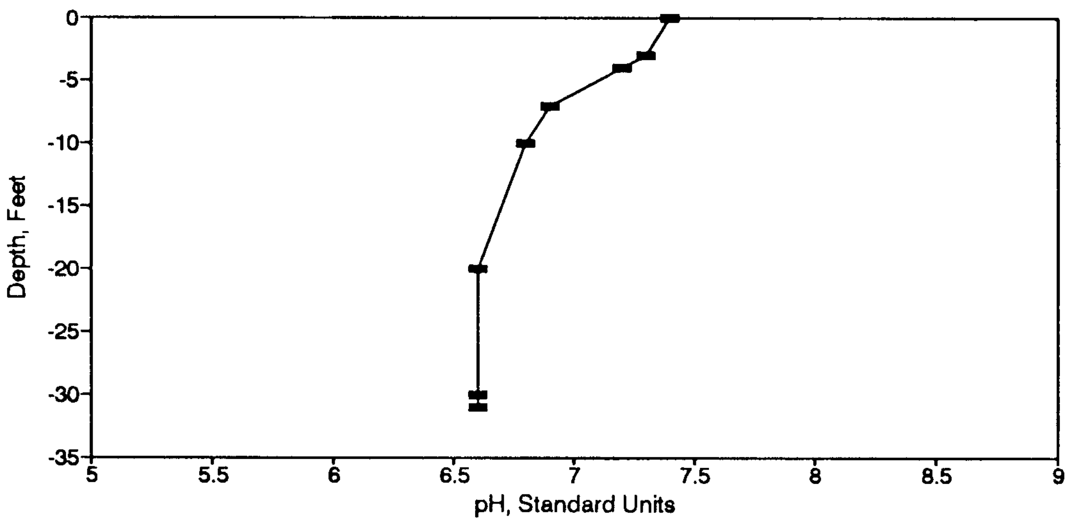

Figure BP56. pH Profile for the Waveland Site-July 22, 1985.

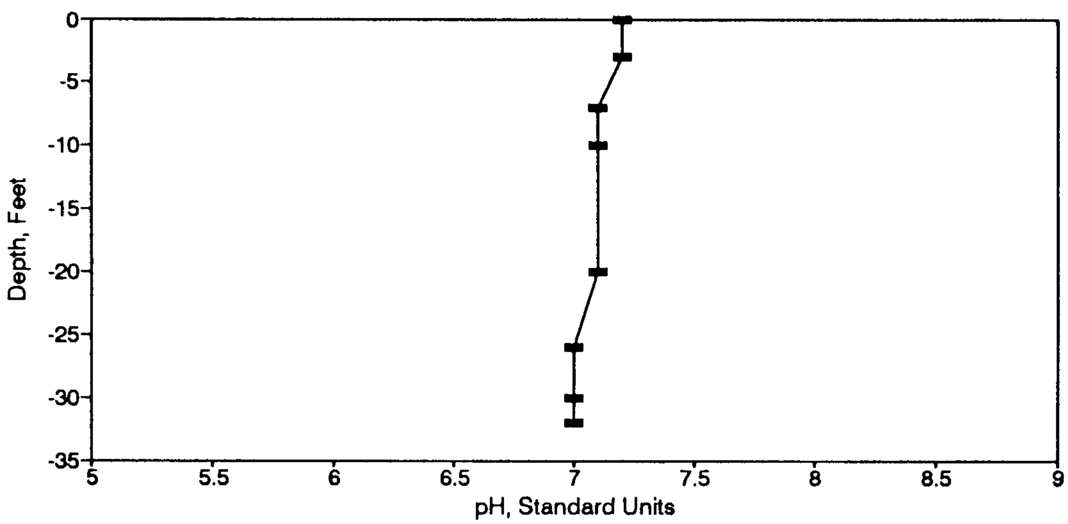

Figure BP57. pH Profile for the Waveland Site-August 23, 1985.

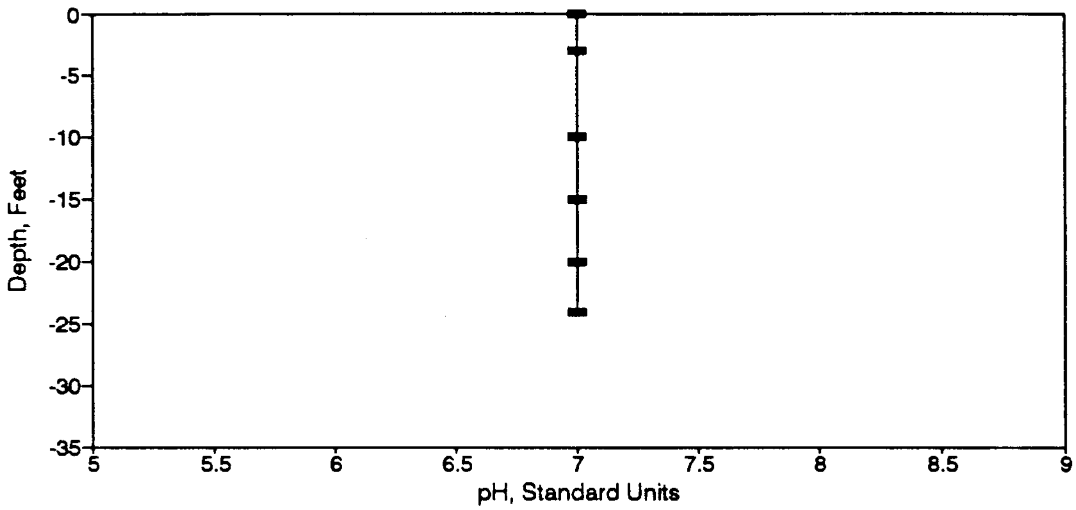

Figure BP58. pH Profile for the Waveland Site-September 23, 1985.

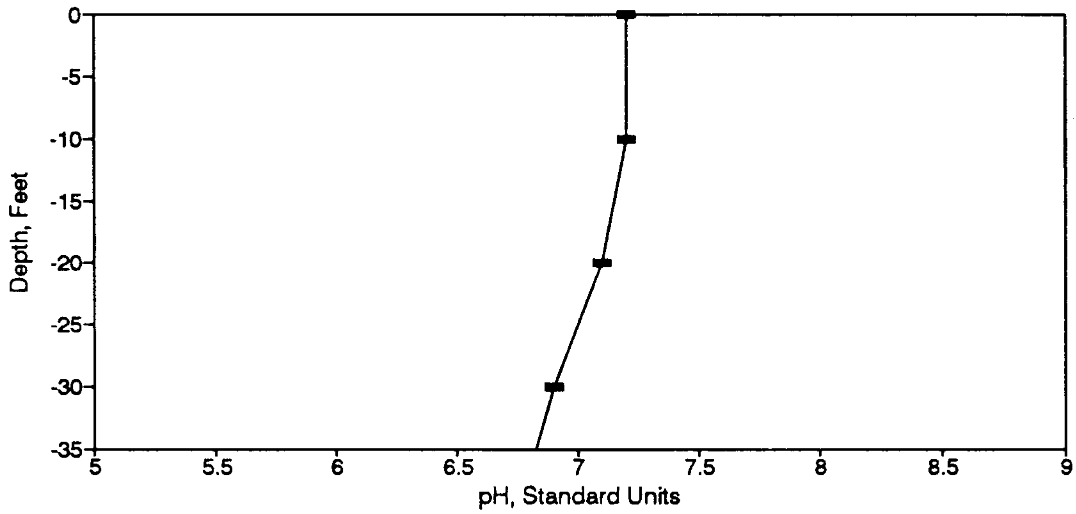

Figure BP59. pH Profile for the Waveland Site-October 16, 1985.

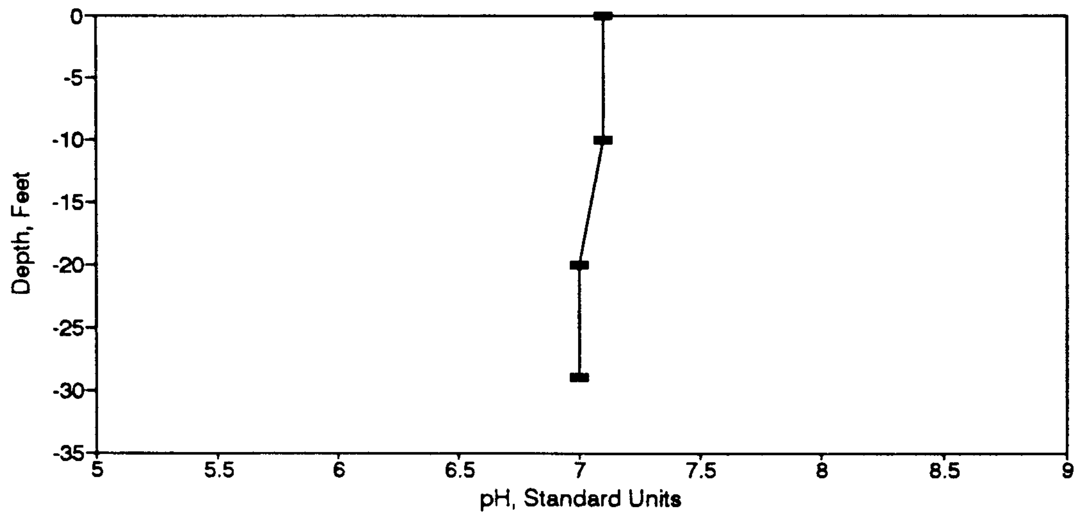

Figure BP60. pH Profile for the Waveland Site-November 18, 1985.

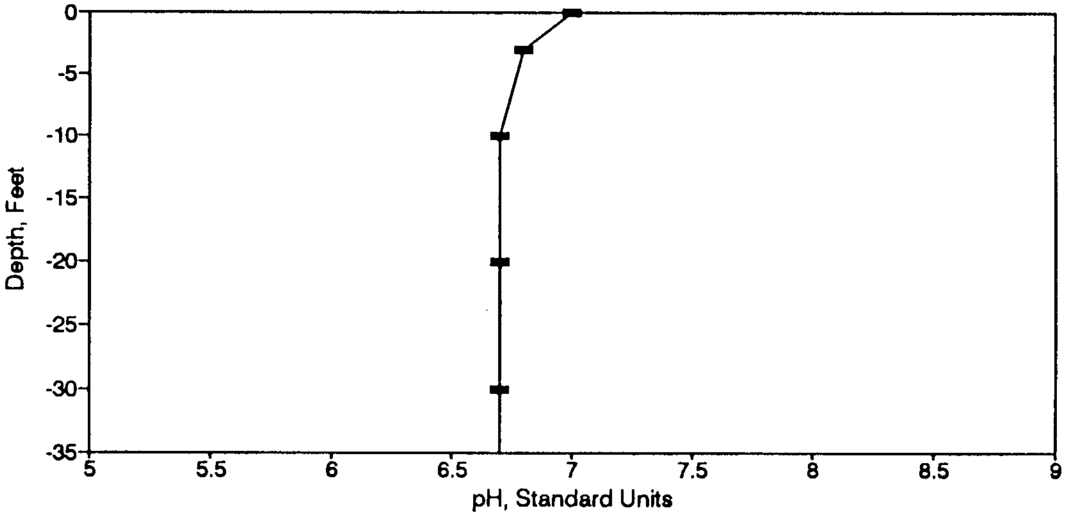

Figure BP61. pH Profile for the Waveland Site-December 12, 1985.

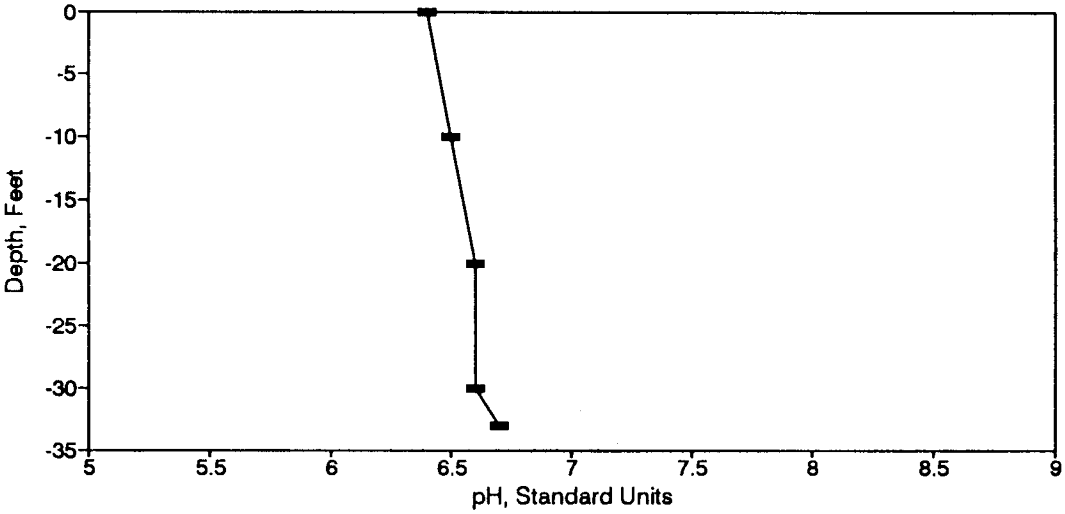

Figure BP62. pH Profile for the Waveland Site-January 14, 1986.

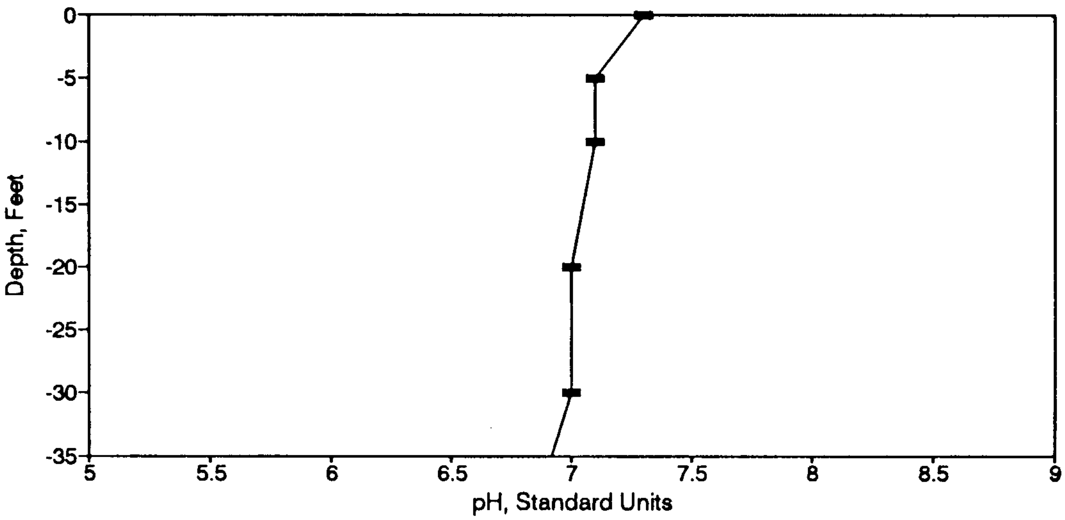

Figure BP63. pH Profile for the Waveland Site-February 3, 1986.

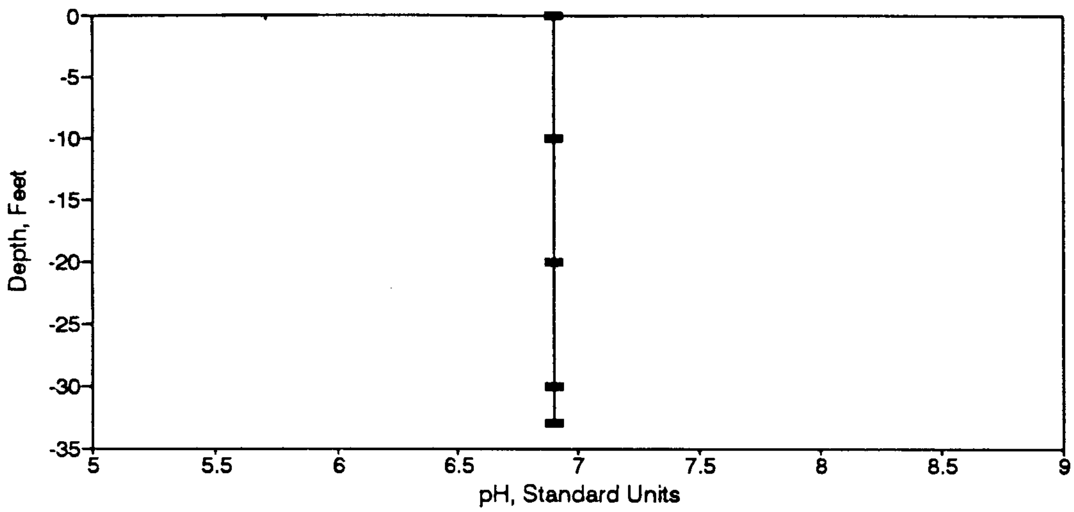

Figure BP64. pH Profile for the Waveland Site-March 11, 1986.

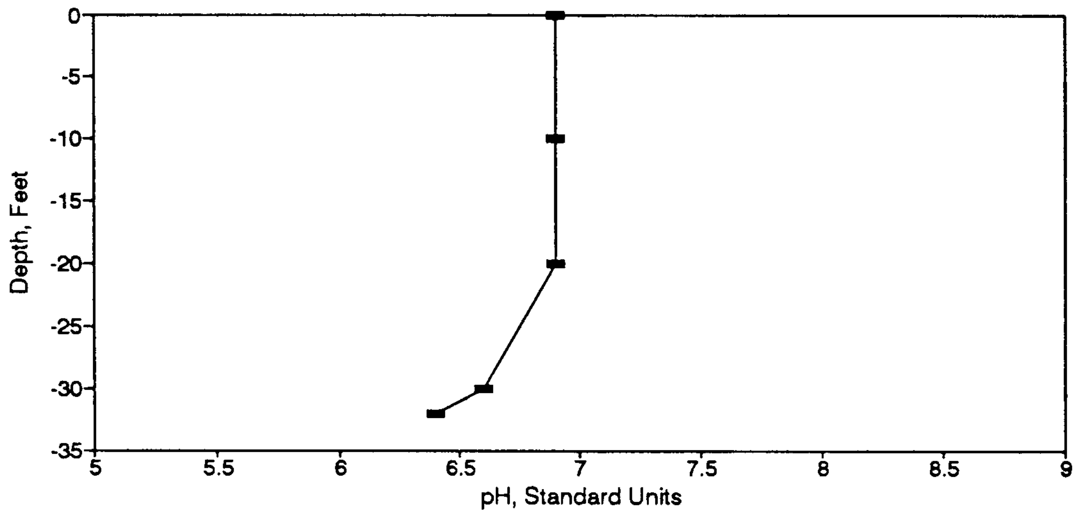

Figure BP65. pH Profile for the Waveland Site-April 14, 1986.

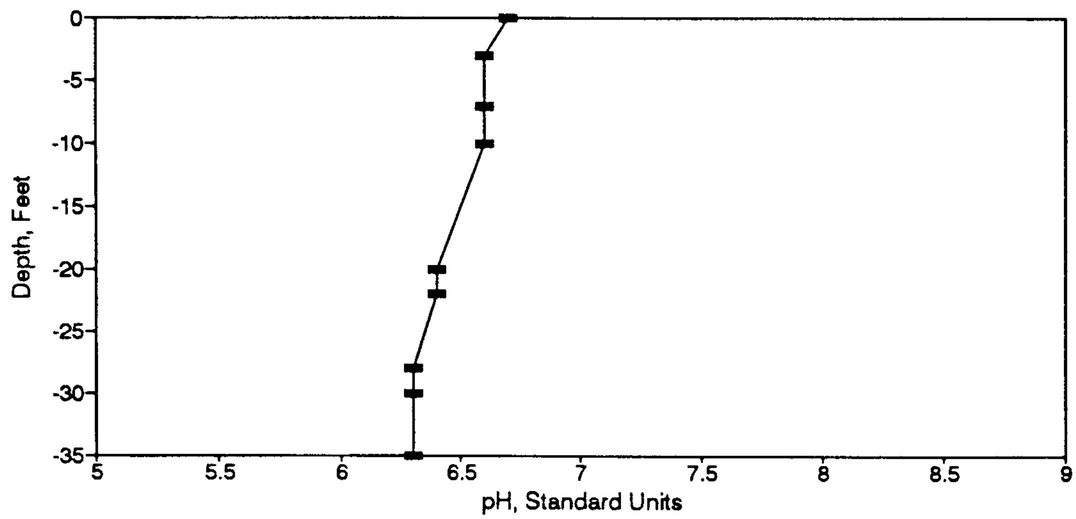

Figure BP66. pH Profile for the Waveland Site-May 15, 1986.

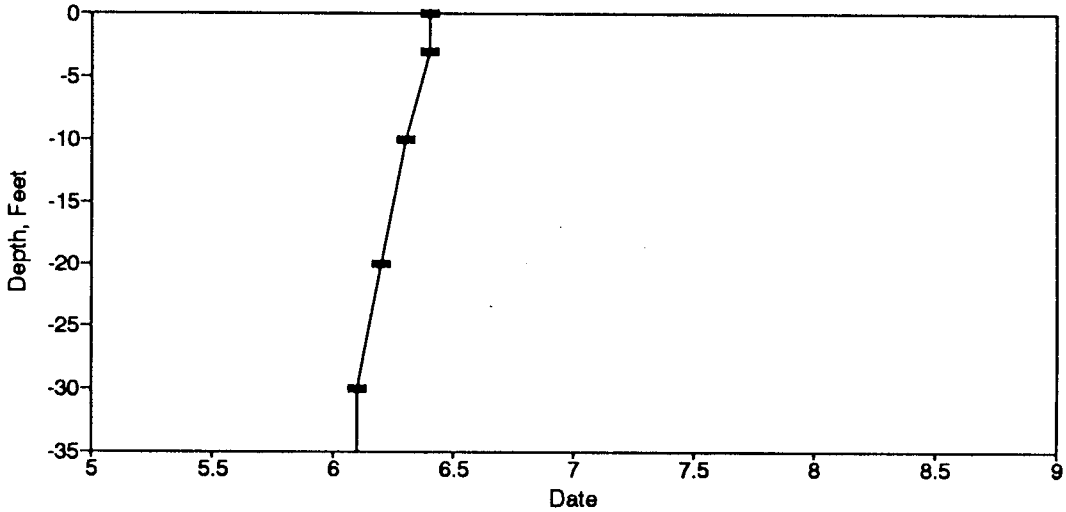

Figure BP67. pH Profile for the Waveland Site-June 9, 1986.

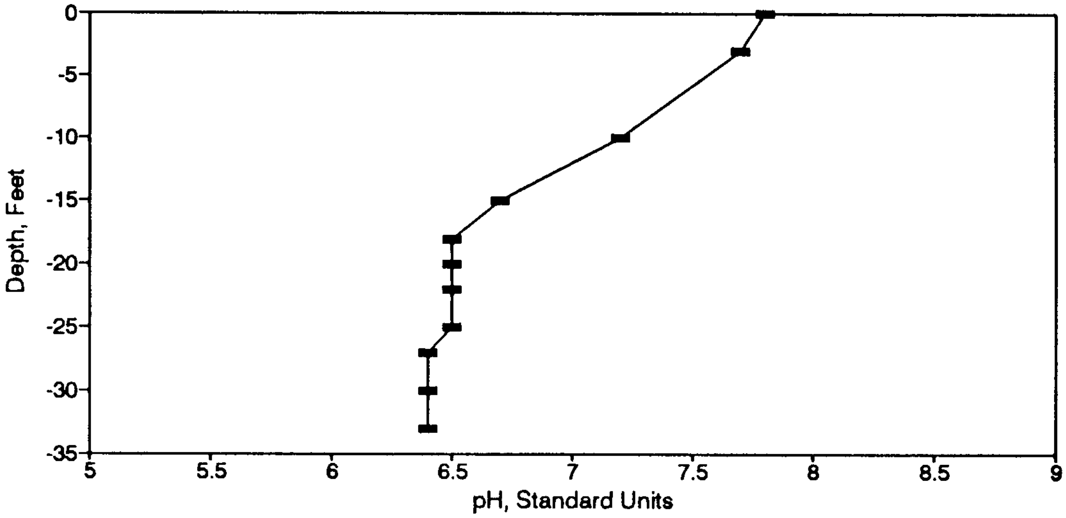

Figure BP68. pH Profile for the Waveland Site-July 15, 1986.

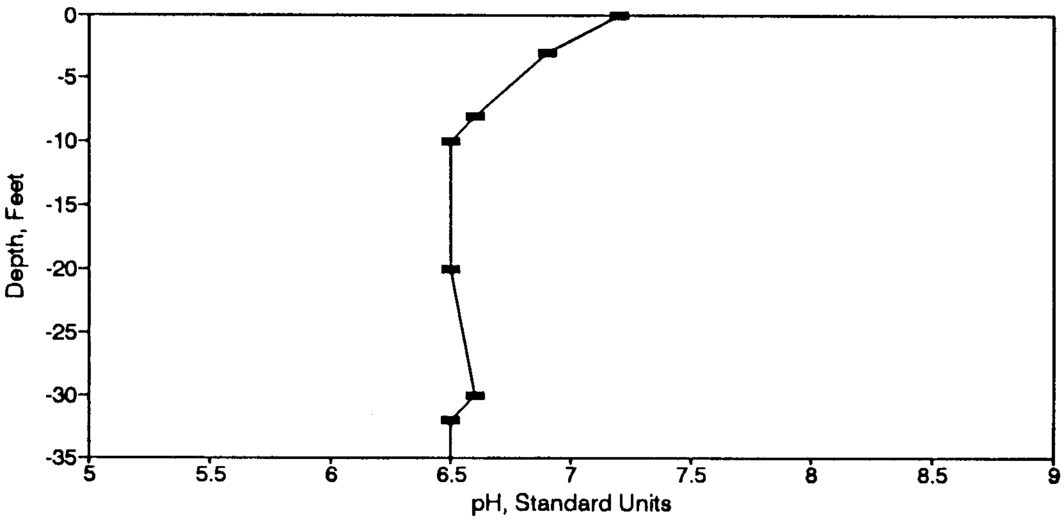

Figure BP69. pH Profile for the Waveland Site-August 21, 1986.

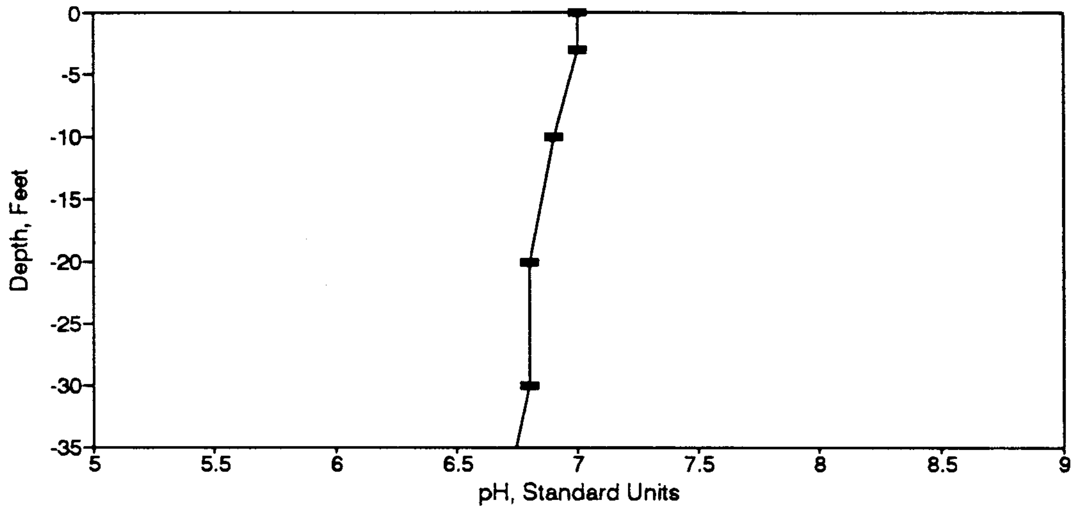

Figure BP70. pH Profile for the Waveland Site-September 10, 1986.

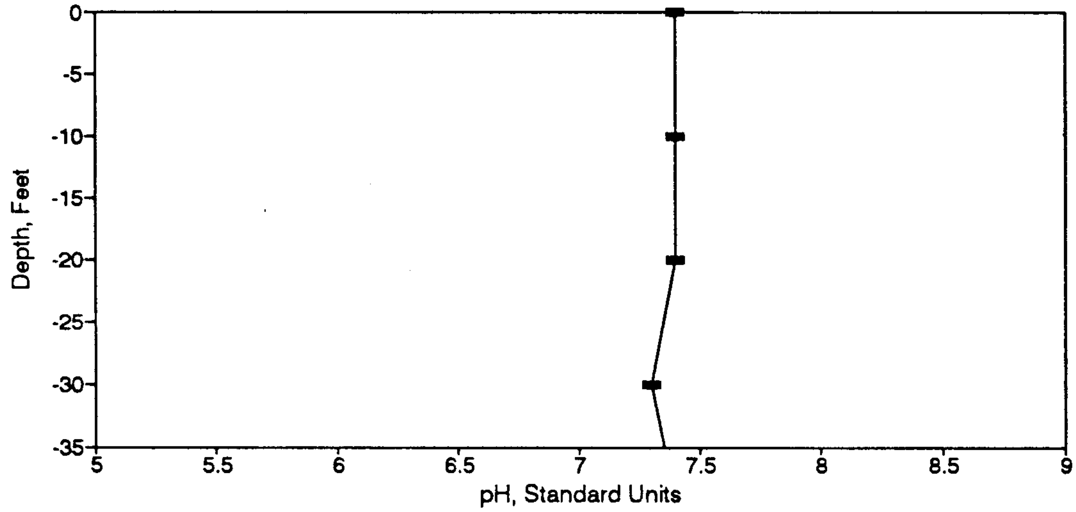

Figure BP71. pH Profile for the Waveland Site-October 14, 1986.

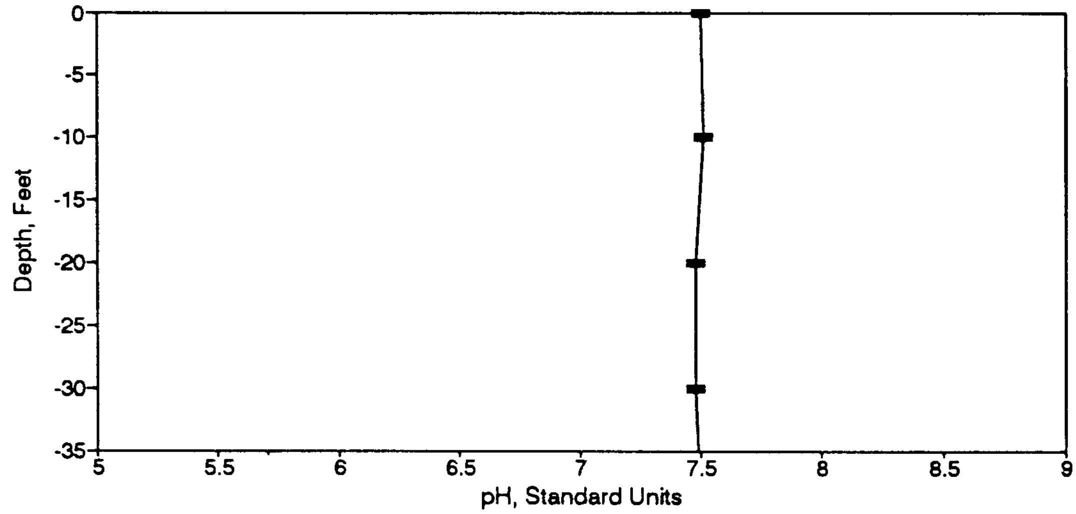

Figure BP72. pH Profile for the Waveland Site-November 3, 1986.

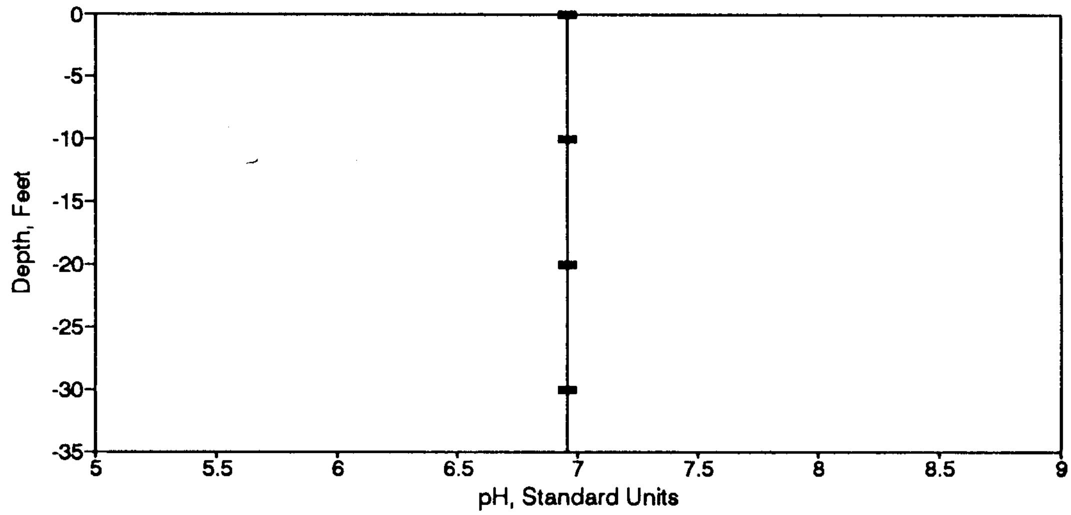

Figure BP73. pH Profile for the Waveland Site-December 8, 1986.

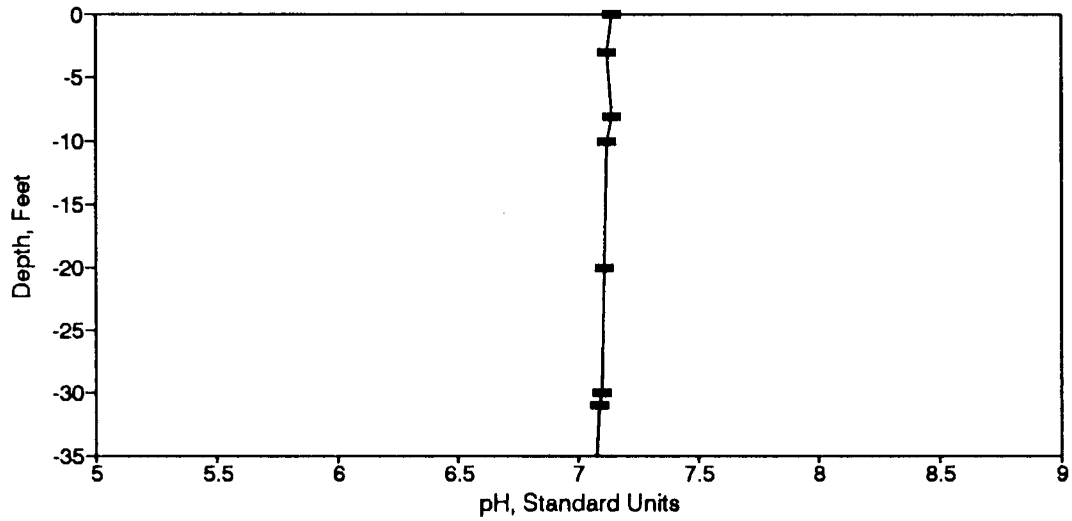

Figure BP74. pH Profile for the Waveland Site-January 15, 1987.

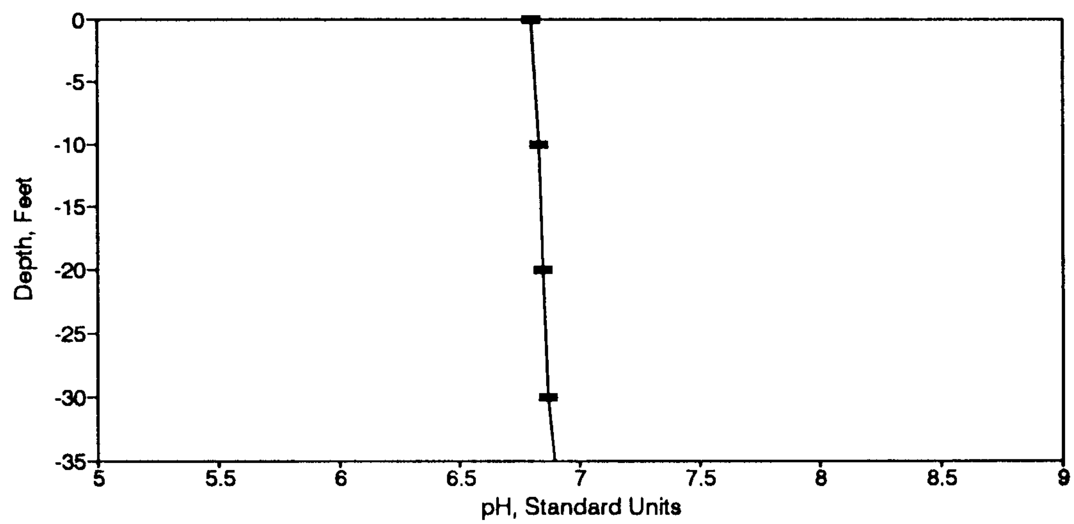

Figure BP75. pH Profile for the Waveland Site-February 10, 1987.

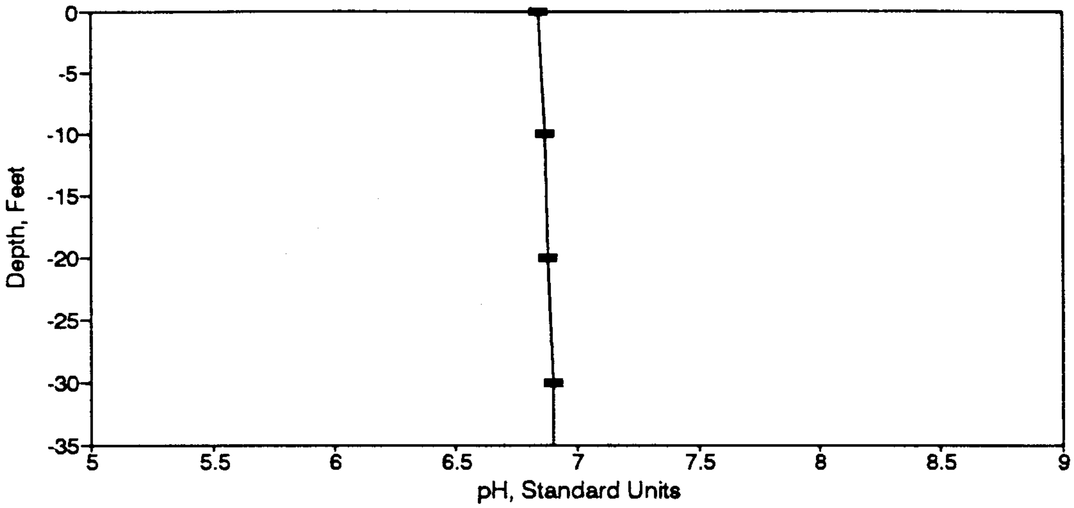

Figure BP76. pH Profile for the Waveland Site-March 2, 1987.

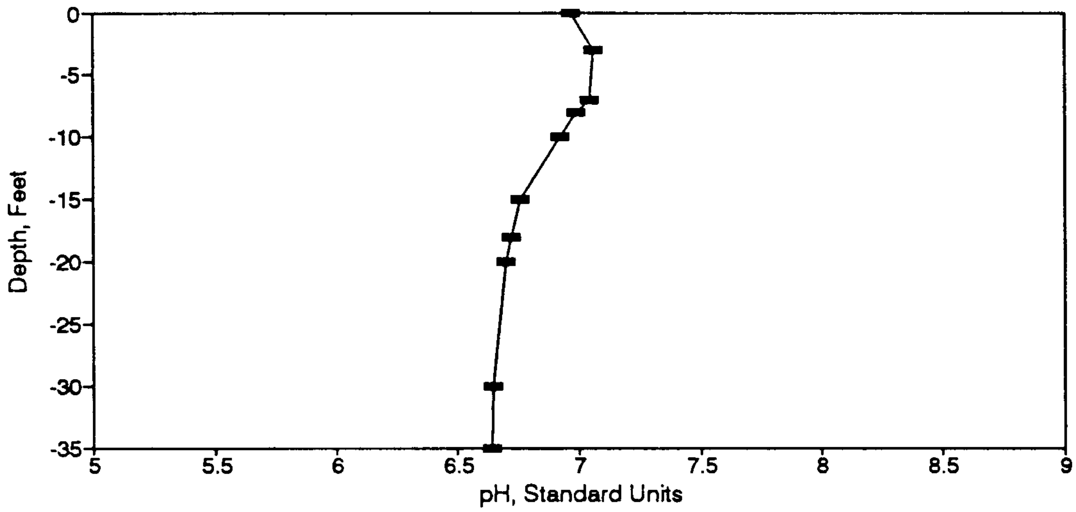

Figure BP77. pH Profile for the Waveland Site-April 30, 1987.

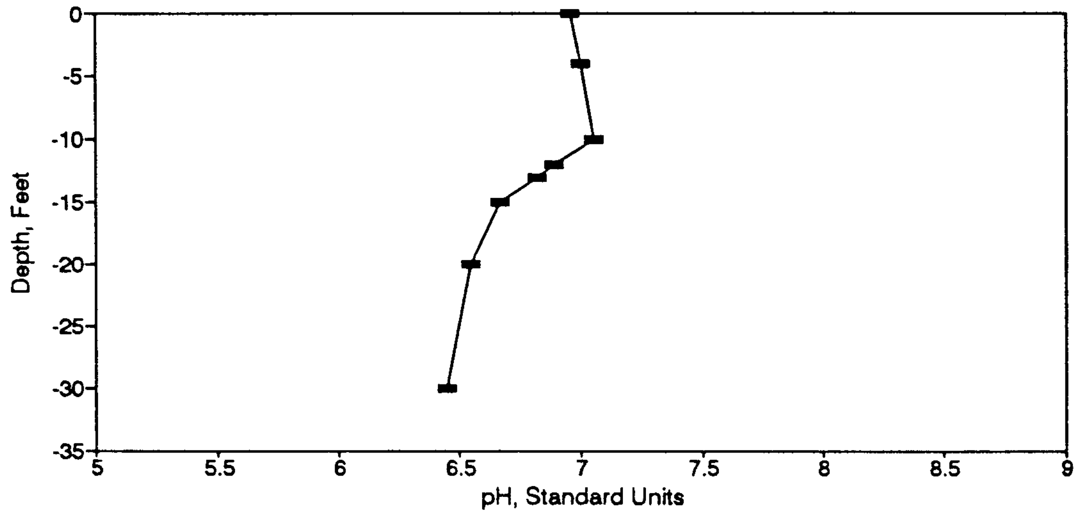

Figure BP78. pH Profile for the Waveland Site-May 15, 1987.

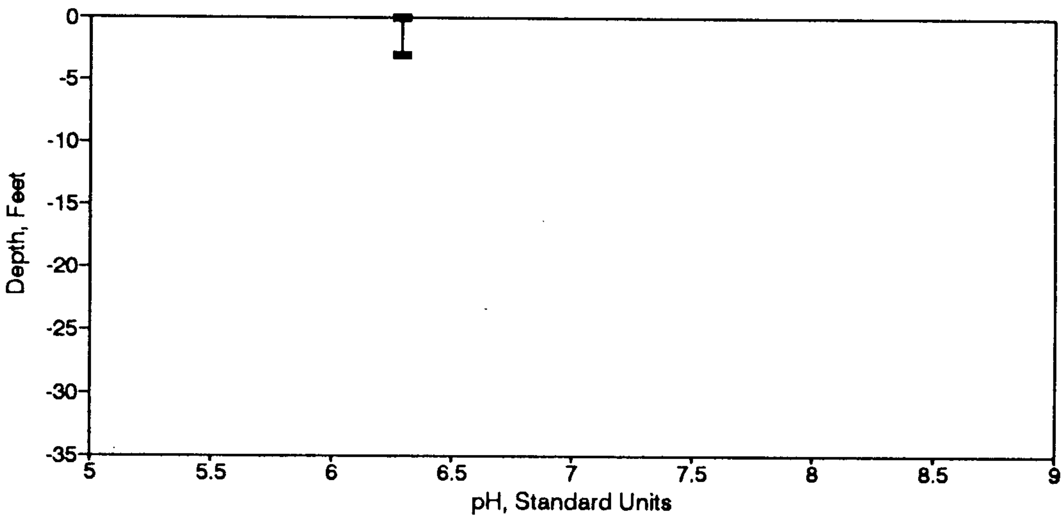

Figure BP79. pH Profile for the Waveland Site-June 1, 1987.

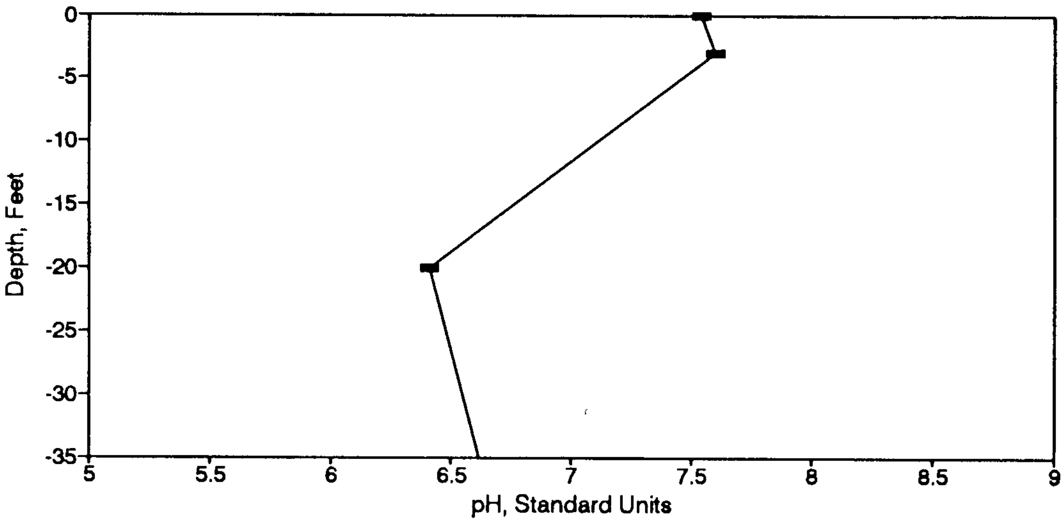

Figure BP80. pH Profile for the Waveland Site-July 6, 1987.

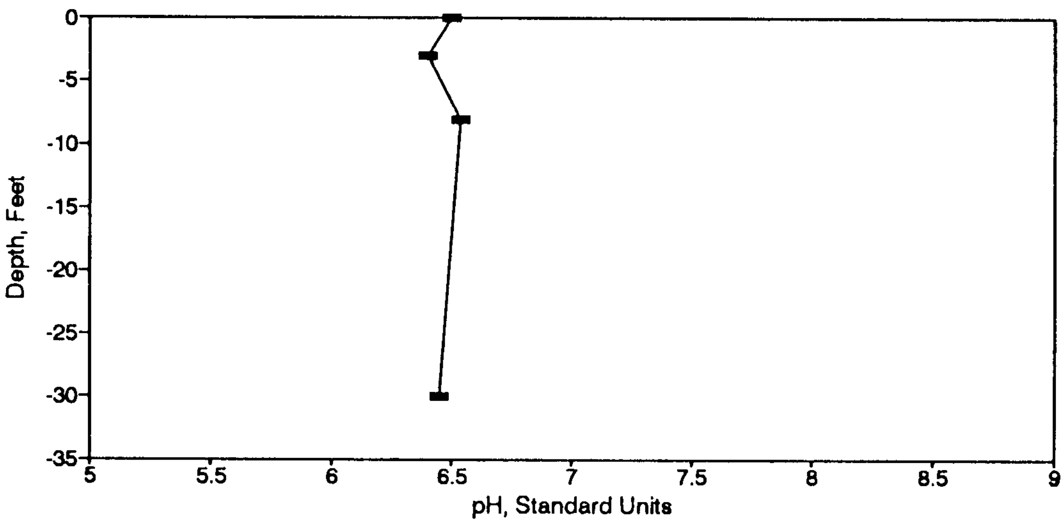

Figure BP81. pH Profile for the Waveland Site-August 6, 1987.

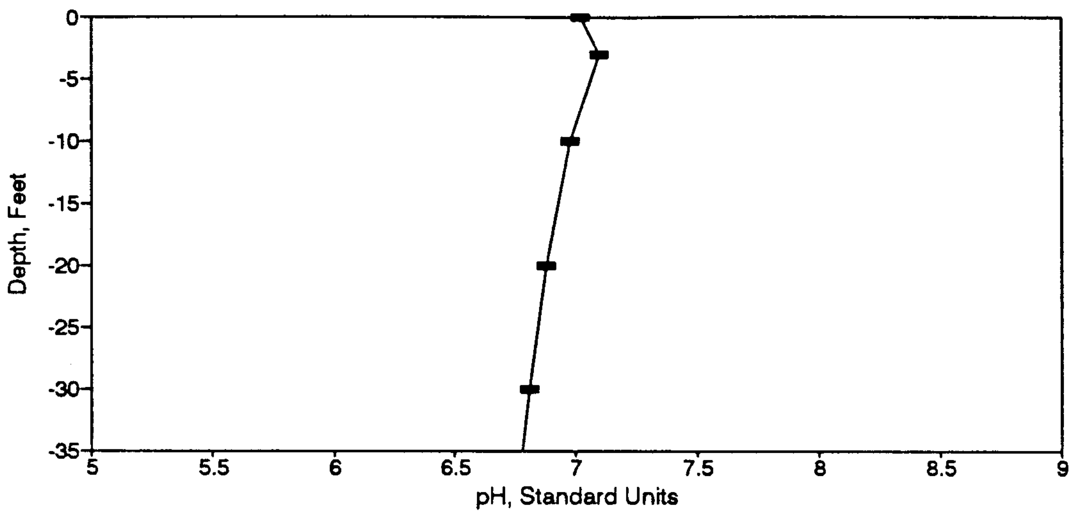

Figure BP82. pH Profile for the Waveland Site-September 2, 1987.

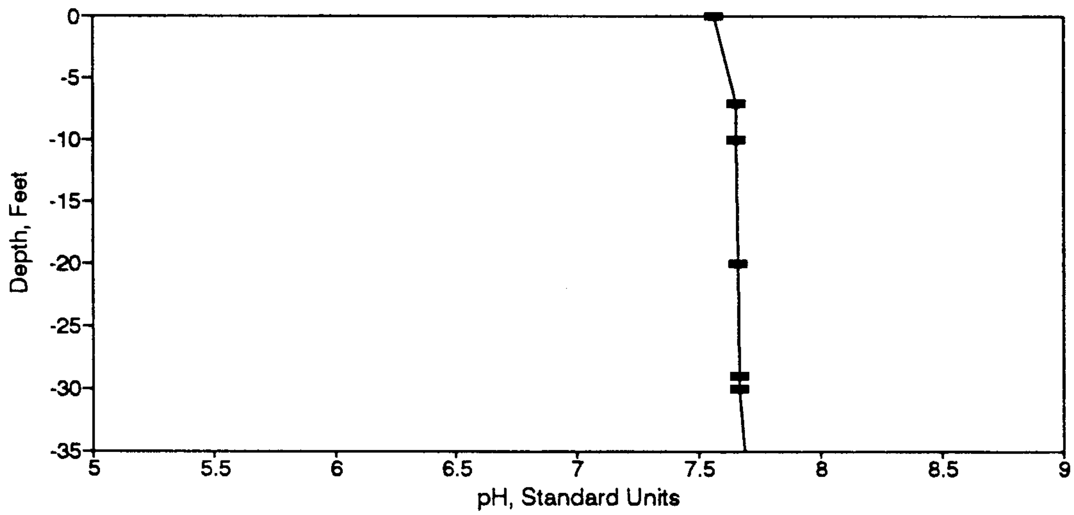

Figure BP83. pH Profile for the Waveland Site-October 6, 1987.

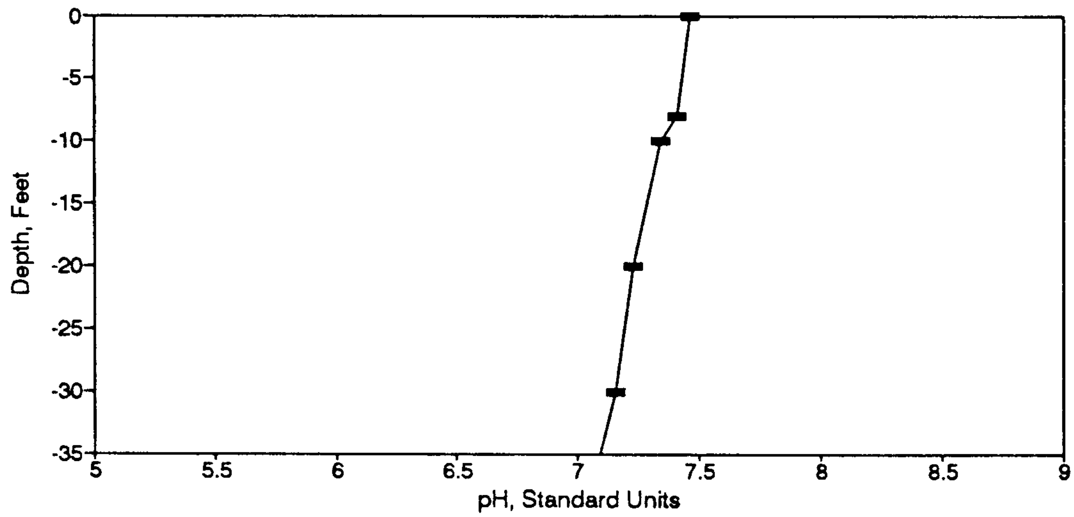

Figure BP84. pH Profile for the Waveland Site-November 2, 1987.

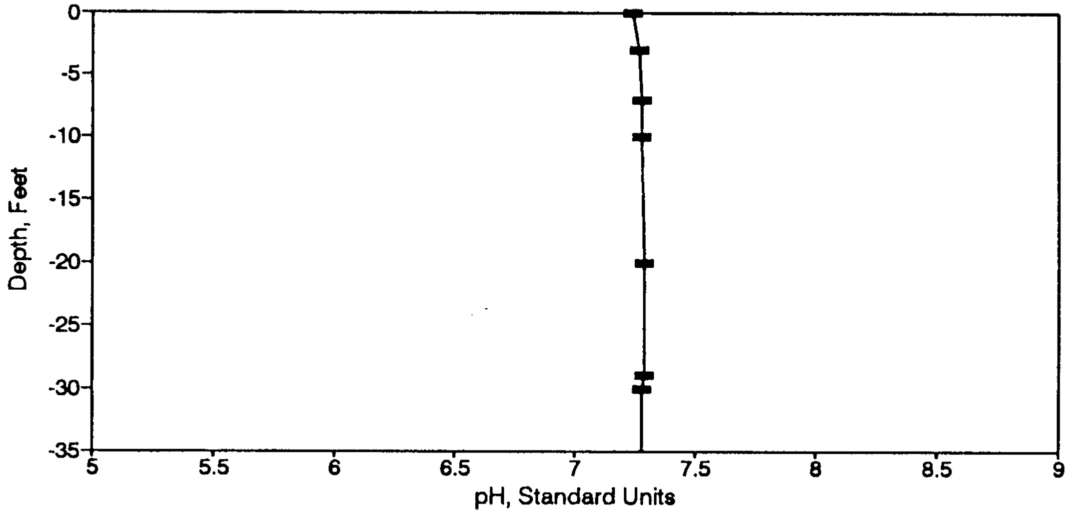

Figure BP85. pH Profile for the Waveland Site-December 3, 1987.

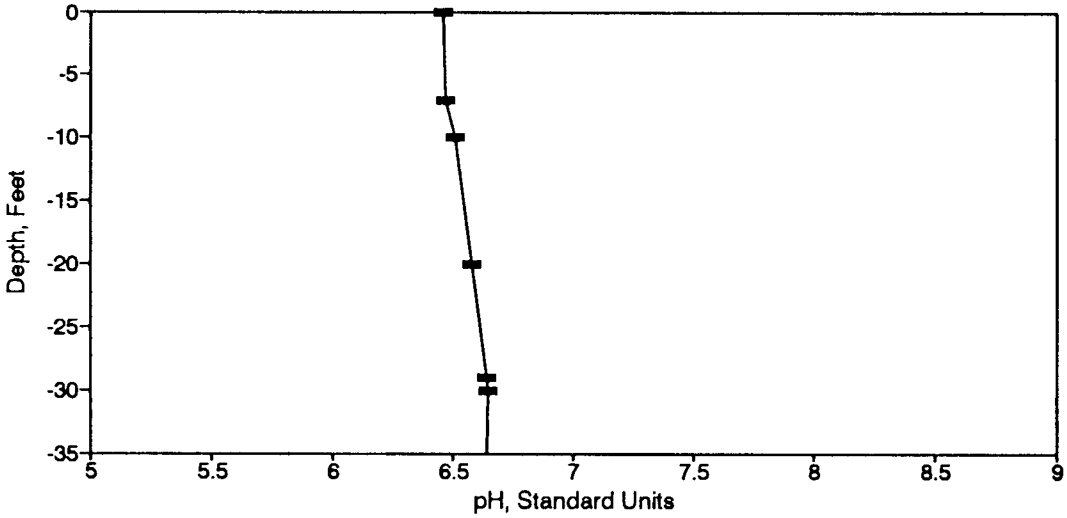

Figure BP86. pH Profile for the Waveland Site-January 25, 1988.

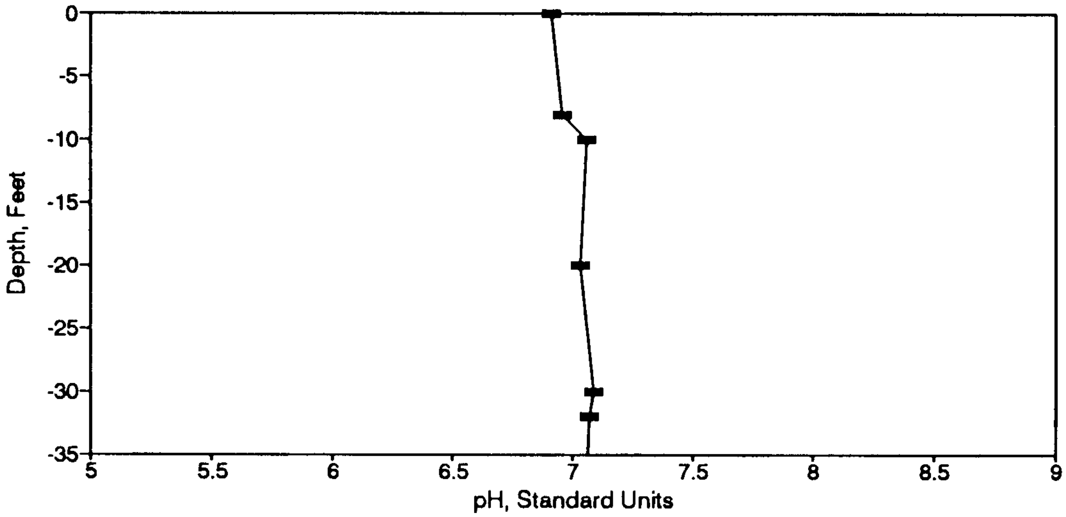

Figure BP87. pH Profile for the Waveland Site-February 16, 1988.

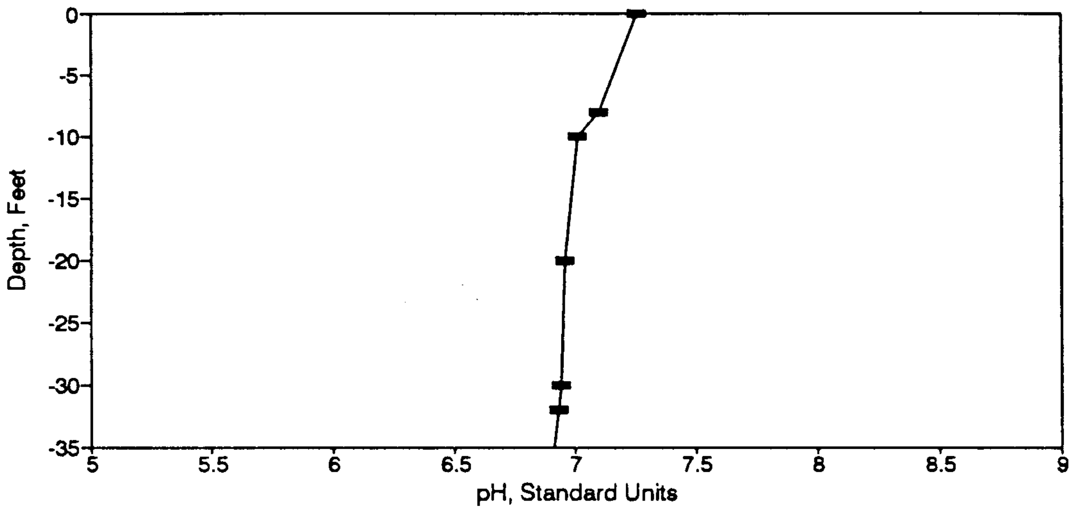

Figure BP88. pH Profile for the Waveland Site-March 9, 1988.

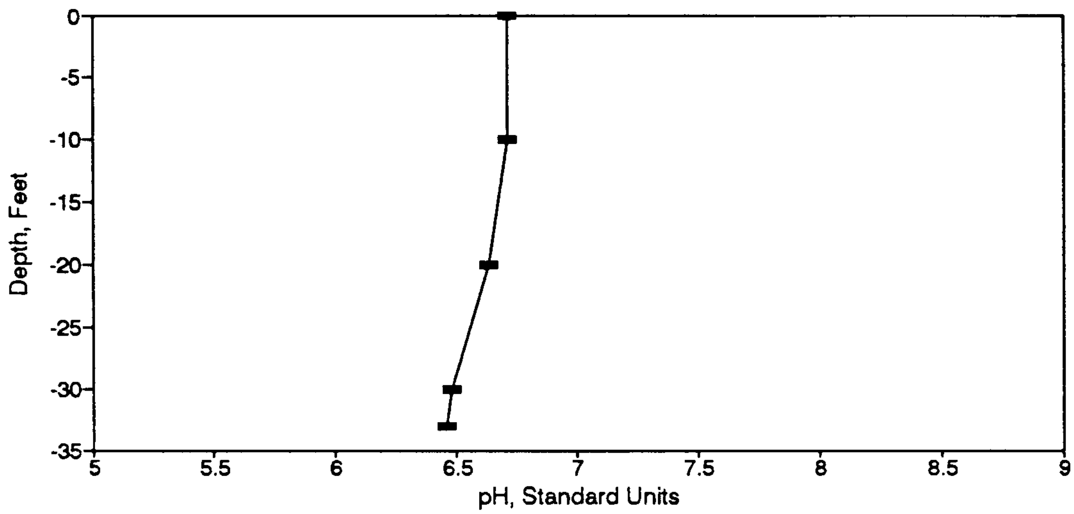

Figure BP89. pH Profile for the Waveland Site-April 25, 1988.

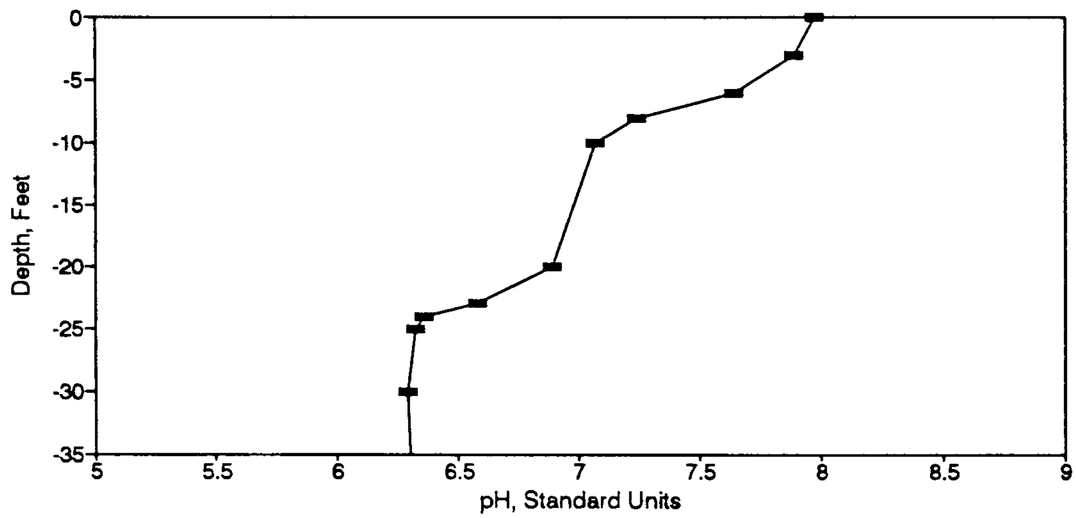

Figure BP90. pH Profile for the Waveland Site-May 12, 1988.

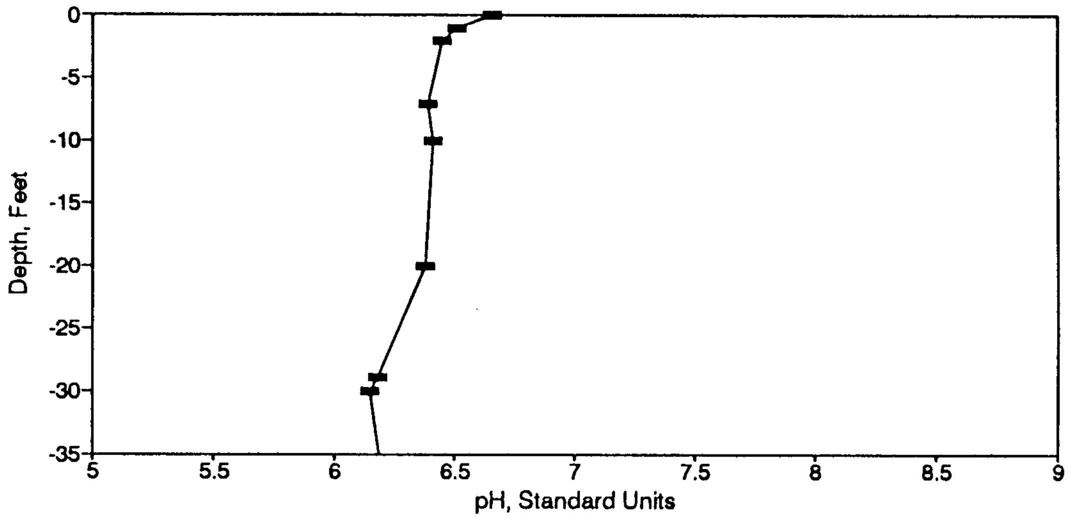

Figure BP91. pH Profile for the Waveland Site-June 15, 1988.

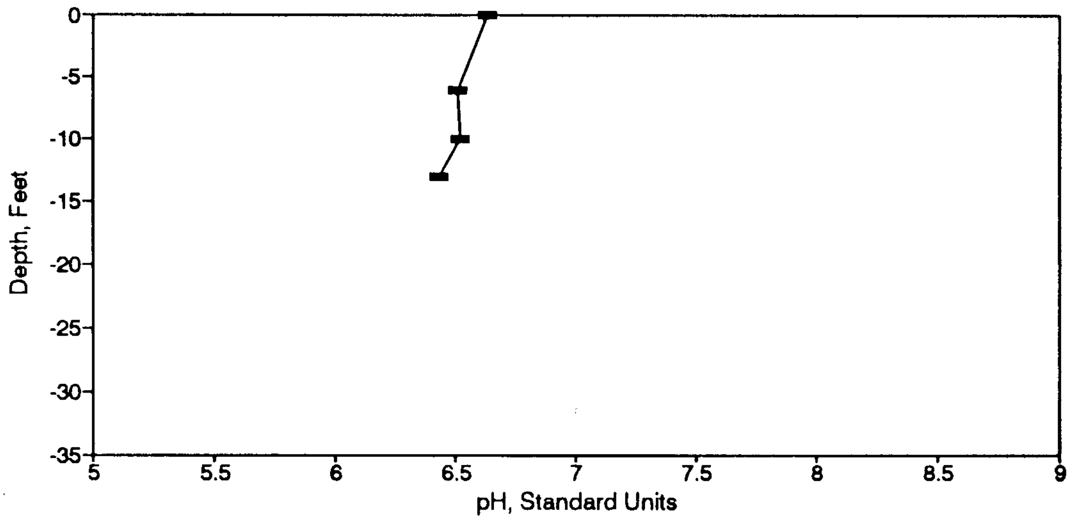

Figure BP92. pH Profile for the Waveland Site-July 6, 1988.

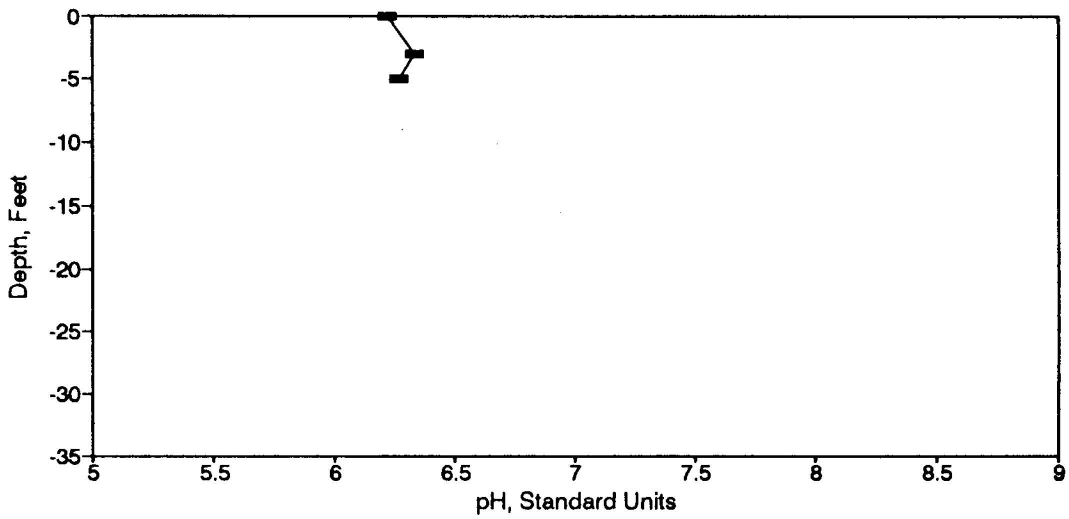

Figure BP93. pH Profile for the Waveland Site-August 11, 1988.

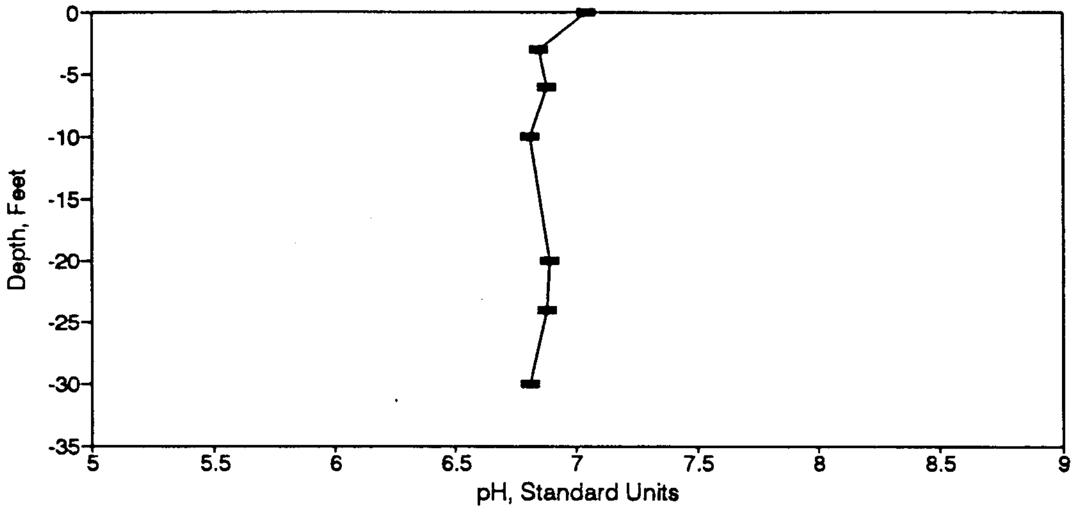

Figure BP94. pH Profile for the Waveland Site-January 12, 1989.

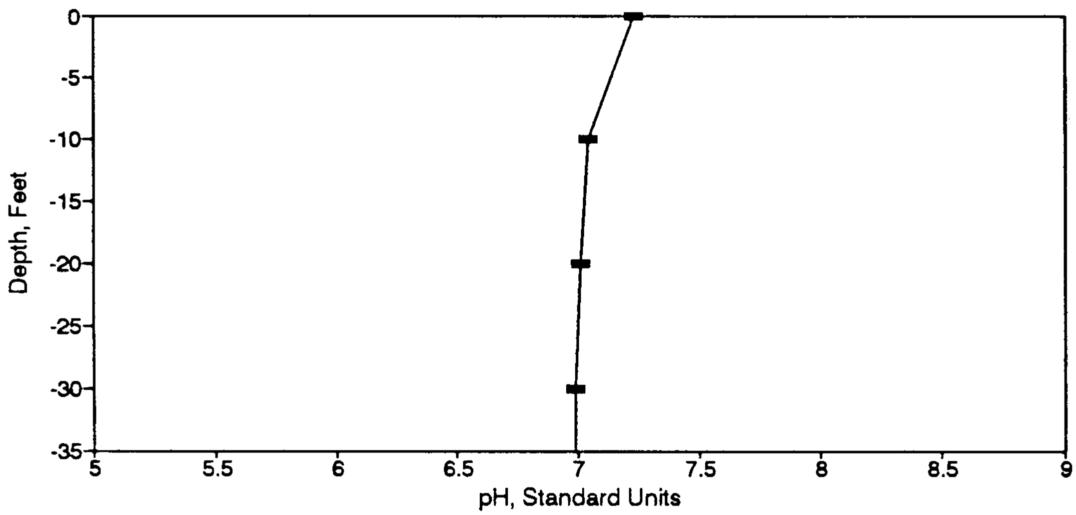

Figure BP95. pH Profile for the Waveland Site-February 1, 1989.

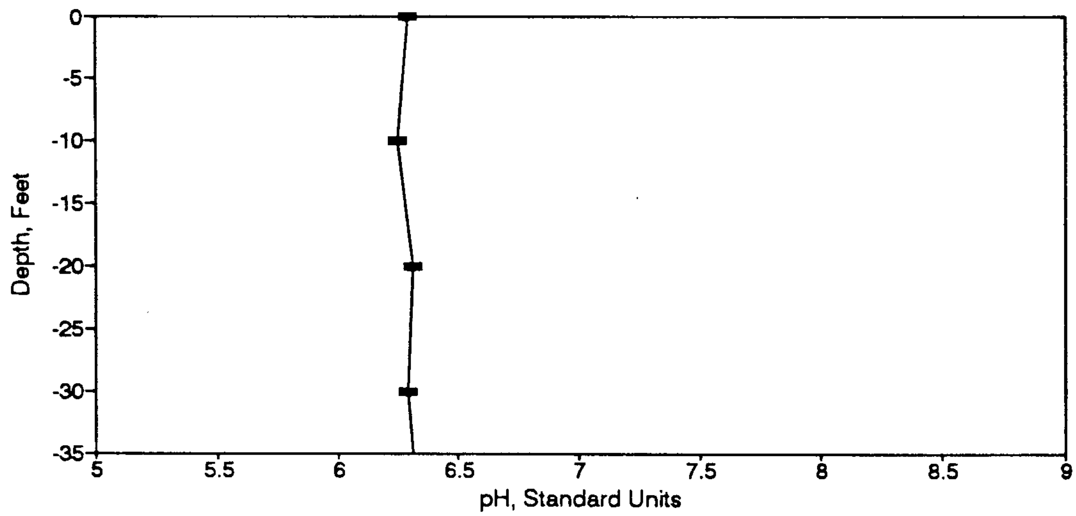

Figure BP96. pH Profile for the Waveland Site-March 20, 1989.

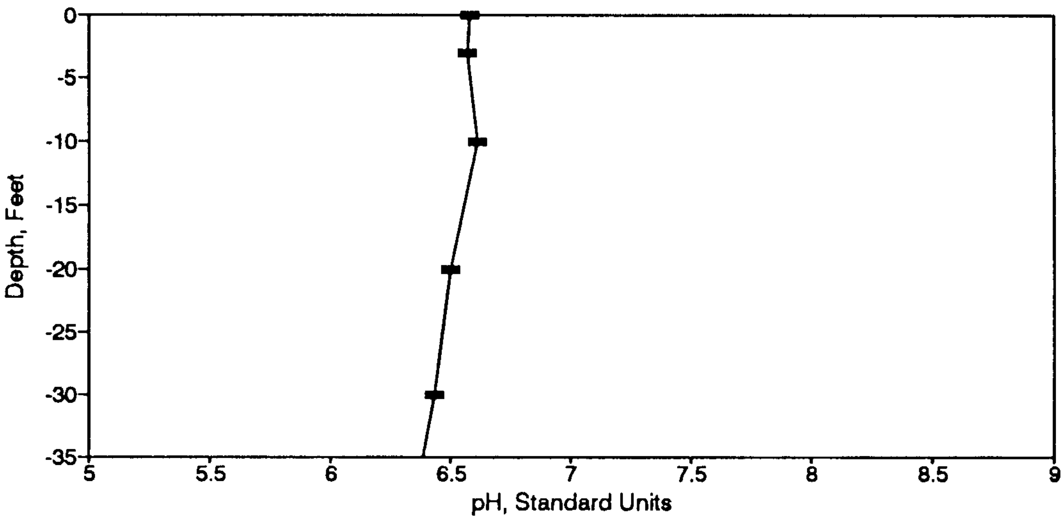

Figure BP97. pH Profile for the Waveland Site-April 17, 1989.

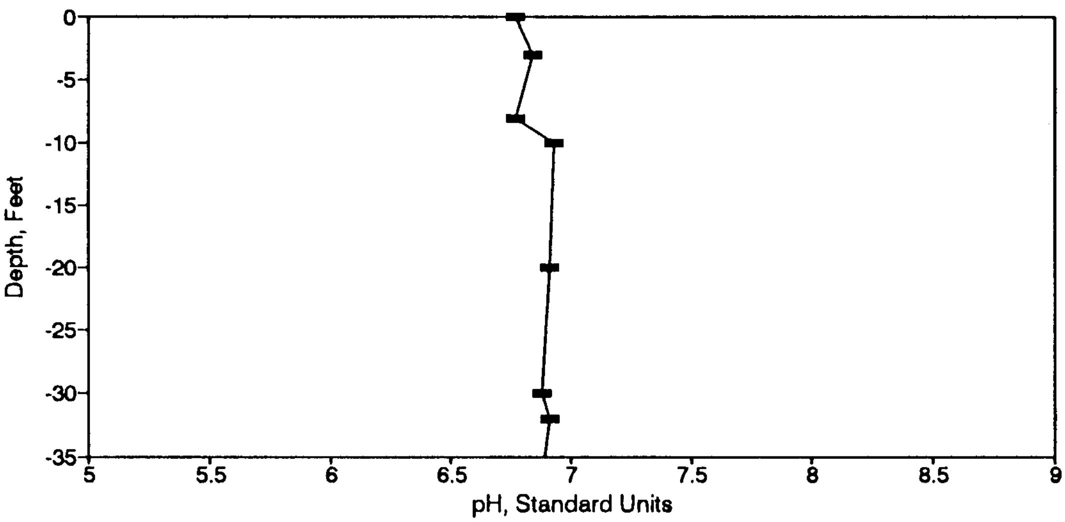

Figure BP98. pH Profile for the Waveland Site-May 11, 1989.

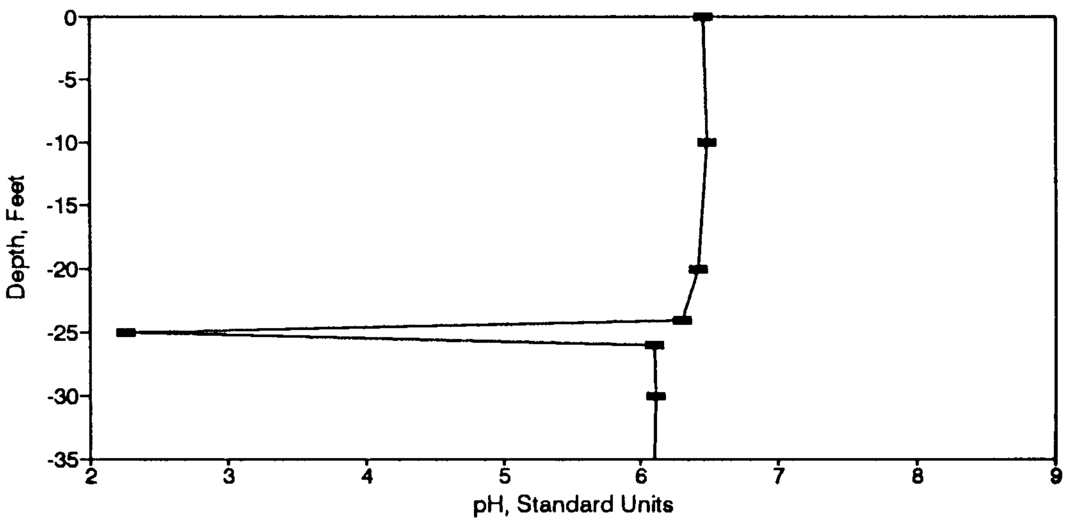

Figure BP99. pH Profile for the Waveland Site-June 19, 1989.

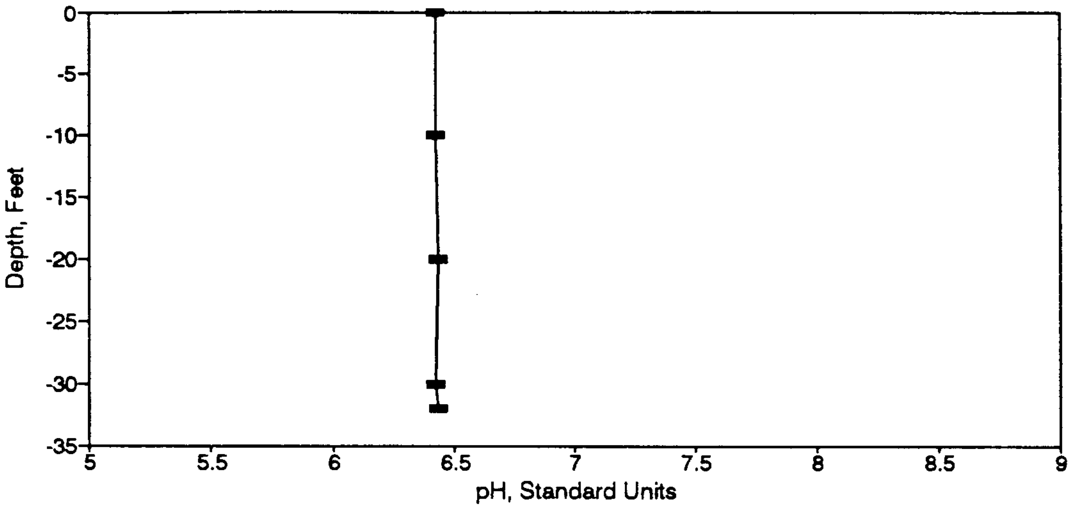

Figure BP100. pH Profile for the Waveland Site-July 17, 1989.

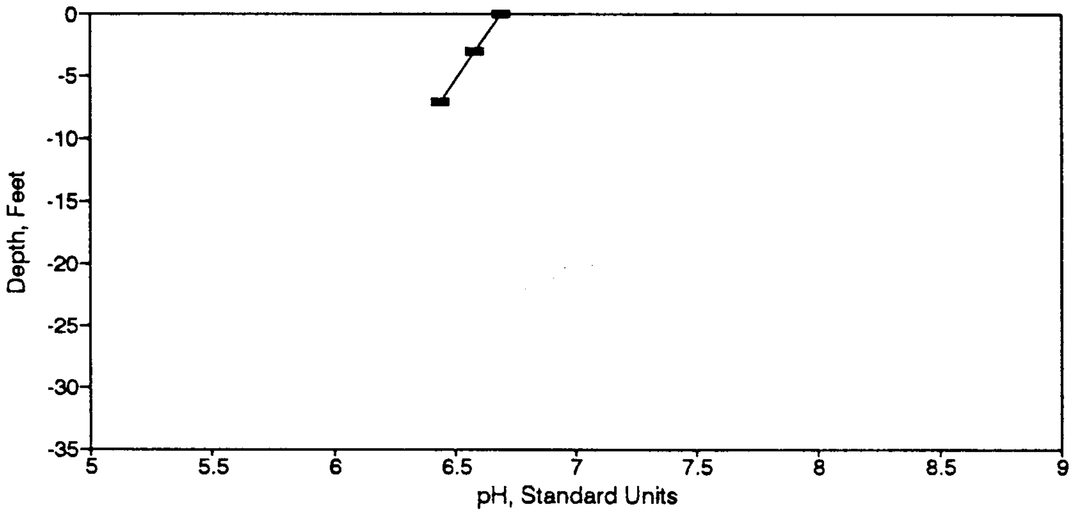

Figure BP101. pH Profile for the Waveland Site-August 7, 1989.

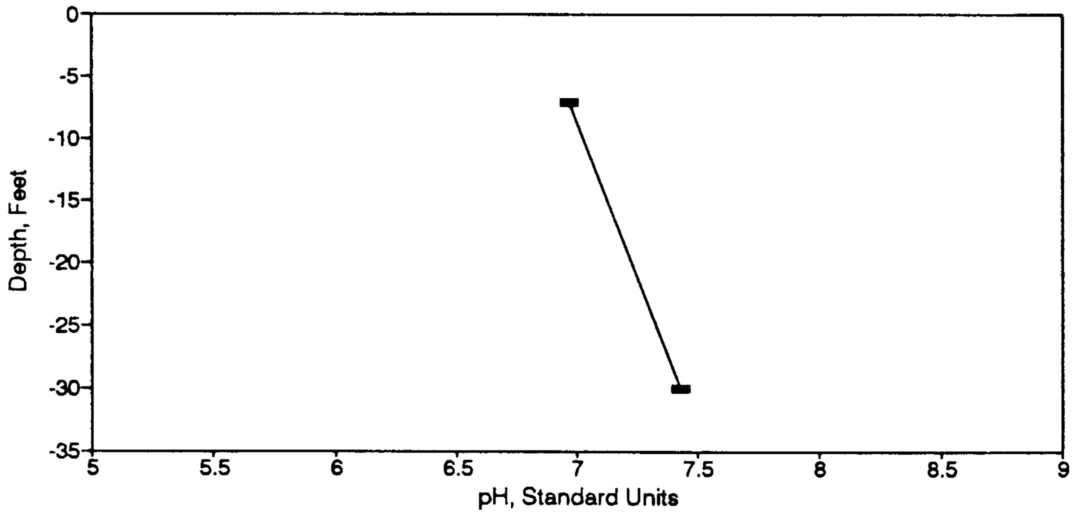

Figure BP102. pH Profile for the Waveland Site-December 13, 1989.

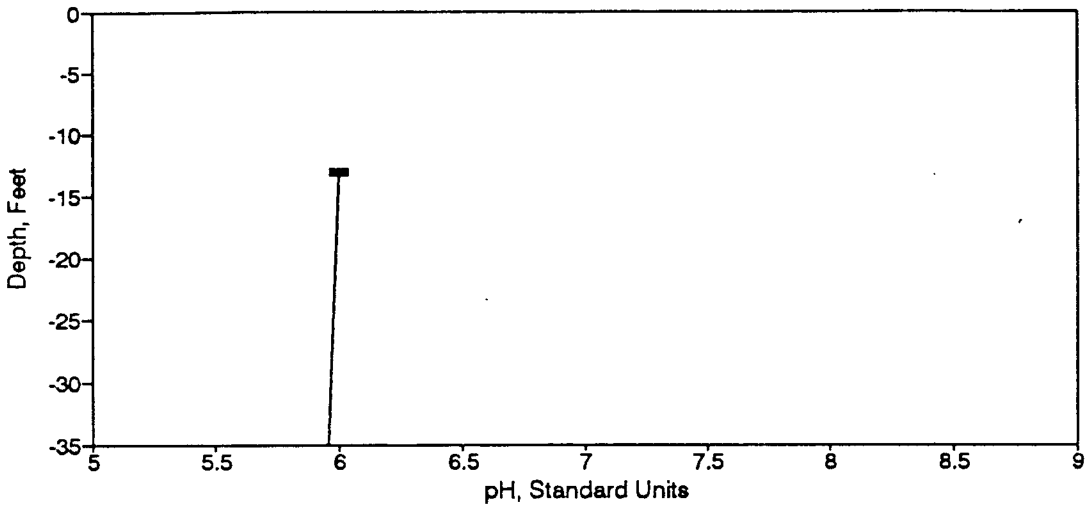

Figure BP103. pH Profile for the Waveland Site-May 24, 1990.

APPENDIX C

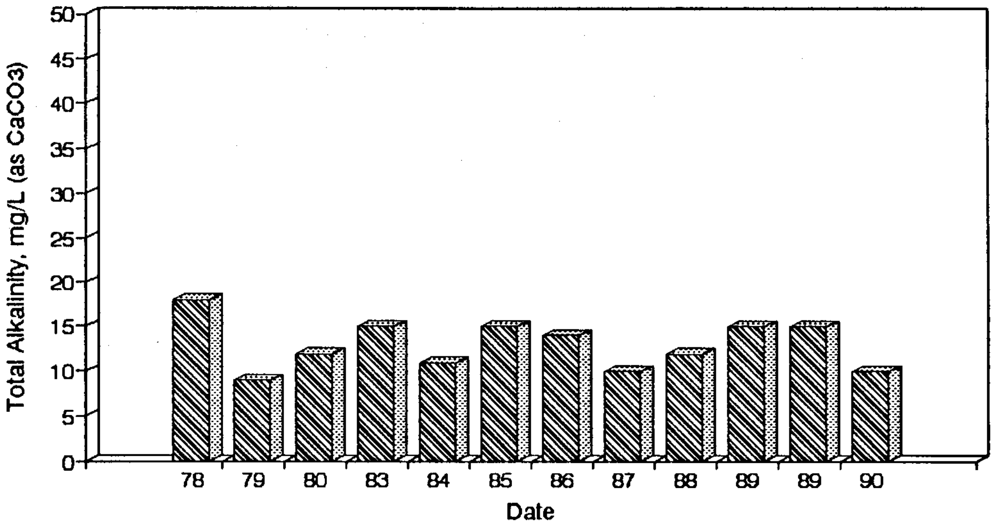

Figure C1. Graph of Total Alkalinity vs. Time for the Ashley Creek Site-May.

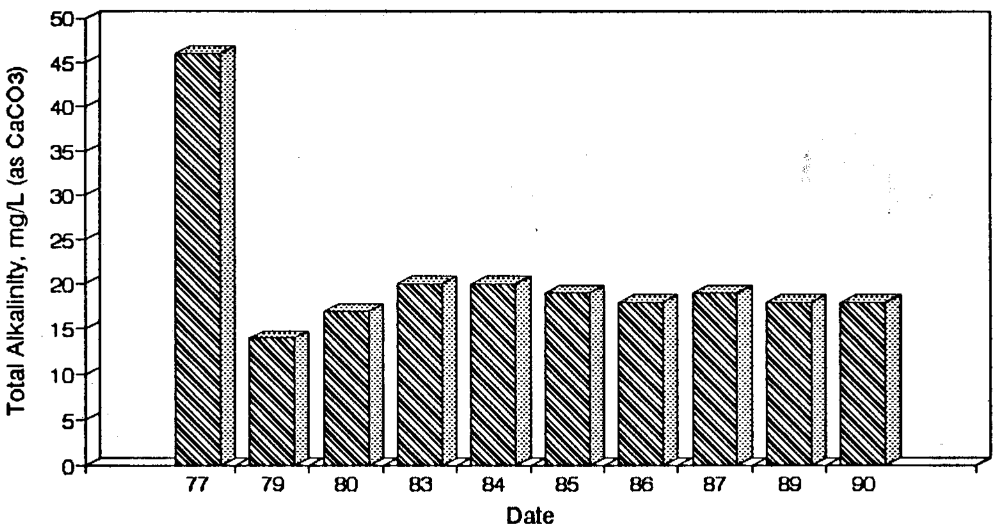

Figure C2. Graph of Total Alkalinity vs. Time for the Ashley Creek Site-Aug.

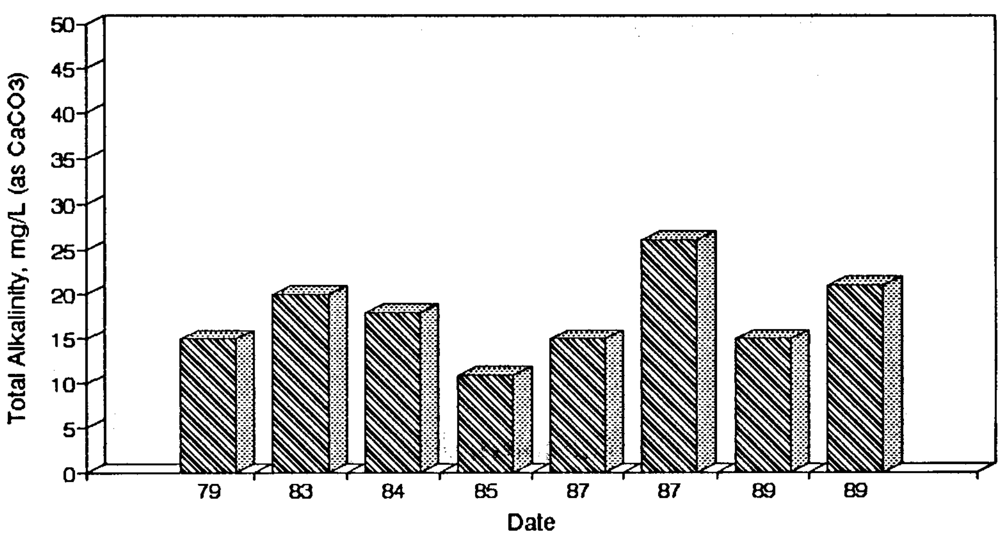

Figure C3. Graph of Total Alkalinity vs. Time for the Ashley Creek Site-Dec.

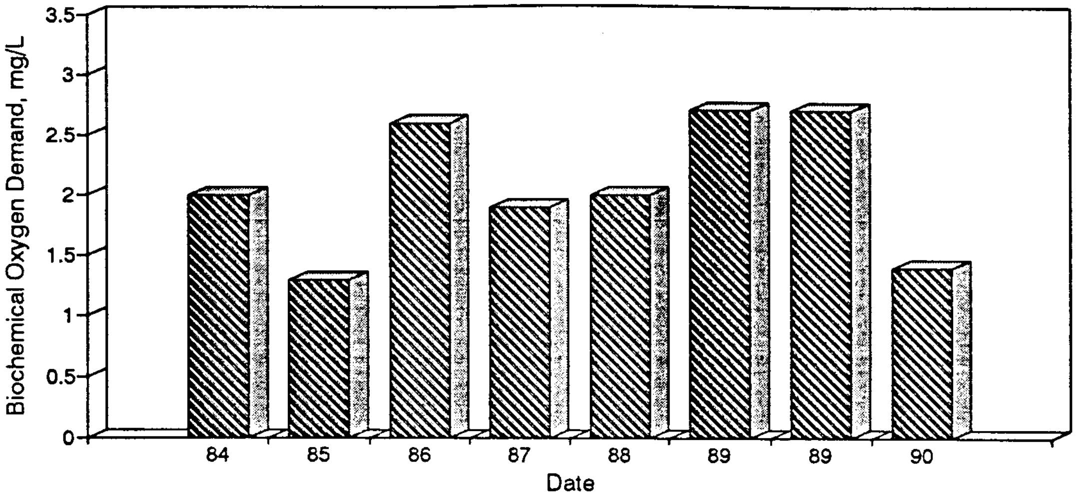

Figure C4. Graph of Biochemical Oxygen Demand vs. Time for the Ashley Creek Site-May.

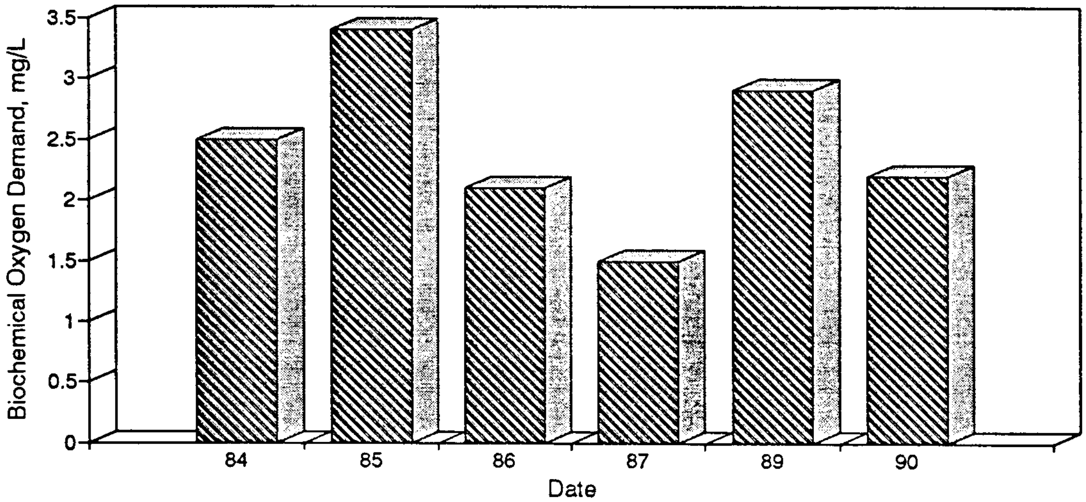

Figure C5. Graph of Biochemical Oxygen Demand vs. Time for the Ashley Creek Site-Aug.

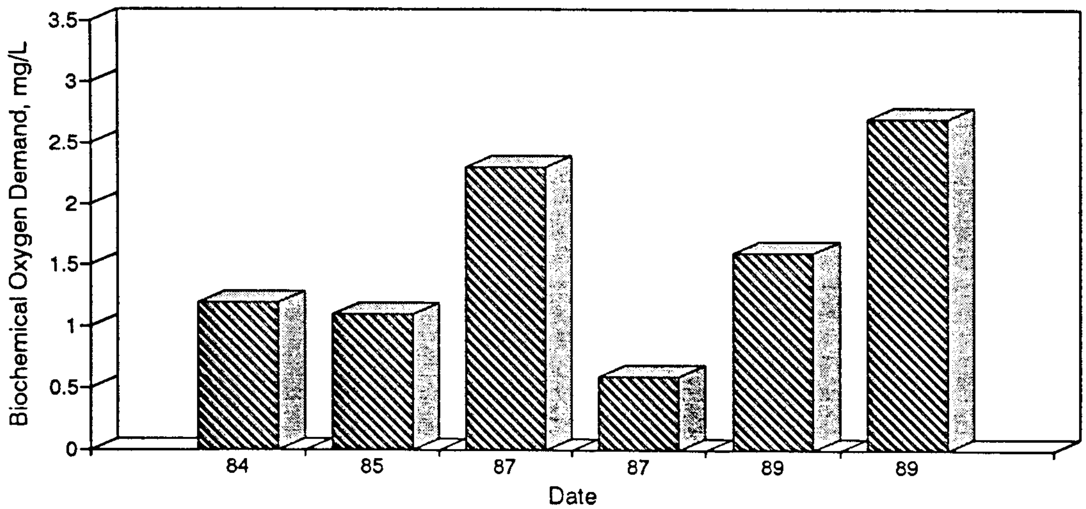

Figure C6. Graph of Biochemical Oxygen Demand vs. Time for the Ashley Creek Site-Dec.

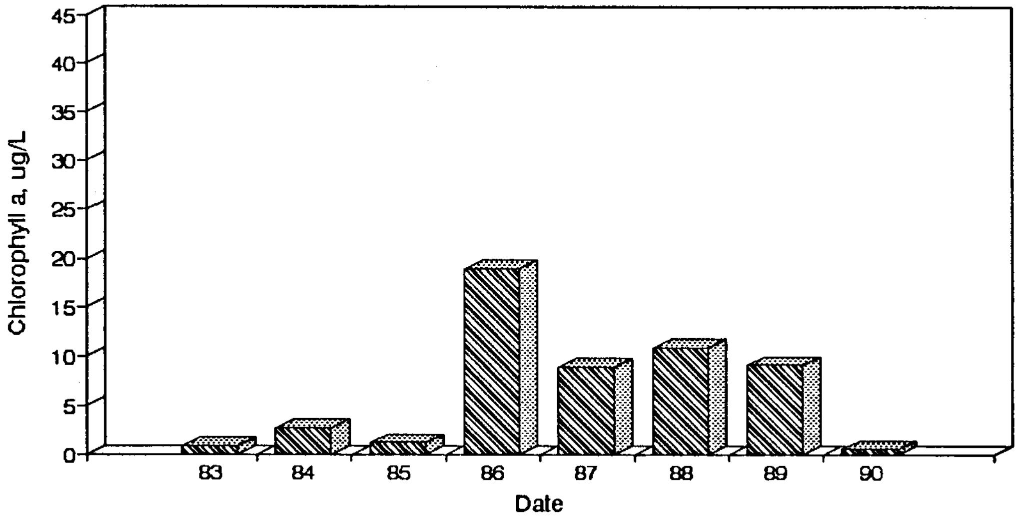

Figure C7. Graph of Chlorophyll a vs. Time for the Ashley Creek Site-May.

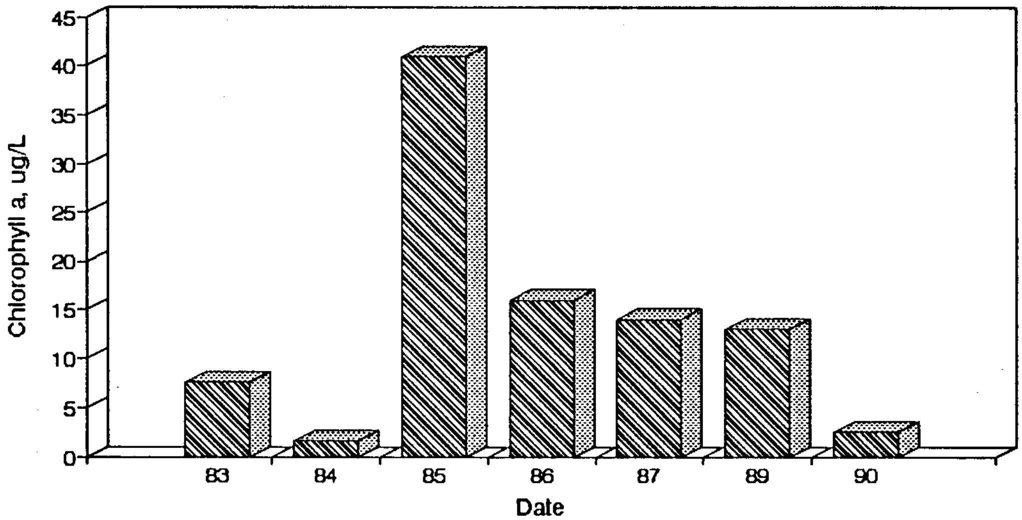

Figure C8. Graph of Chlorophyll a vs. Time for the Ashley Creek Site-Aug.

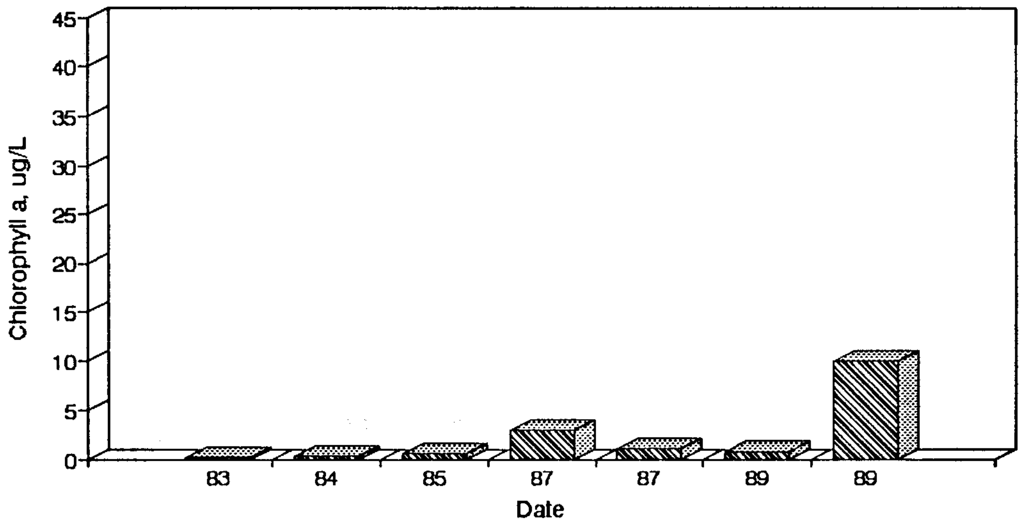

Figure C9. Graph of Chlorophyll a vs. Time for the Ashley Creek Site-Dec.

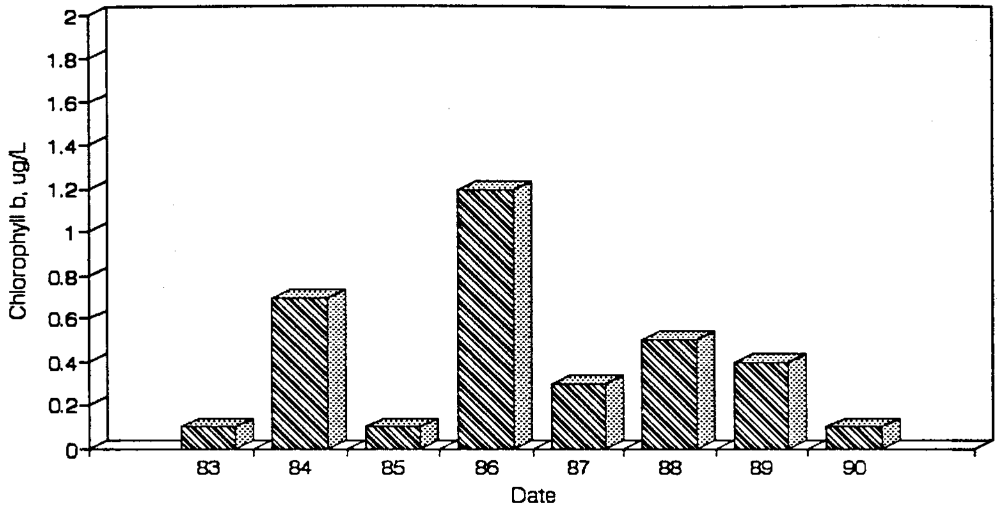

Figure C10. Graph of Chlorophyll b vs. Time for the Ashley Creek Site-May.

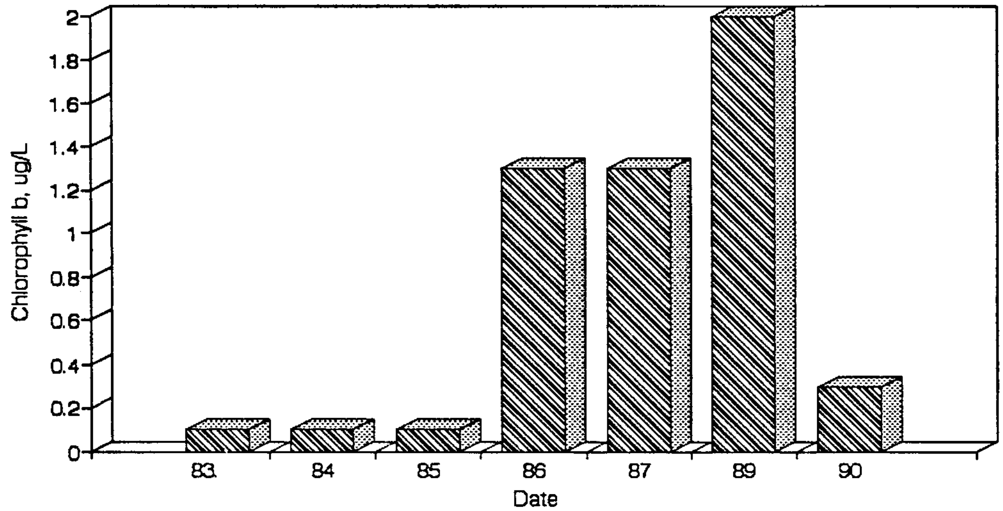

Figure C11. Graph of Chlorophyll b vs. Time for the Ashley Creek Site-Aug.

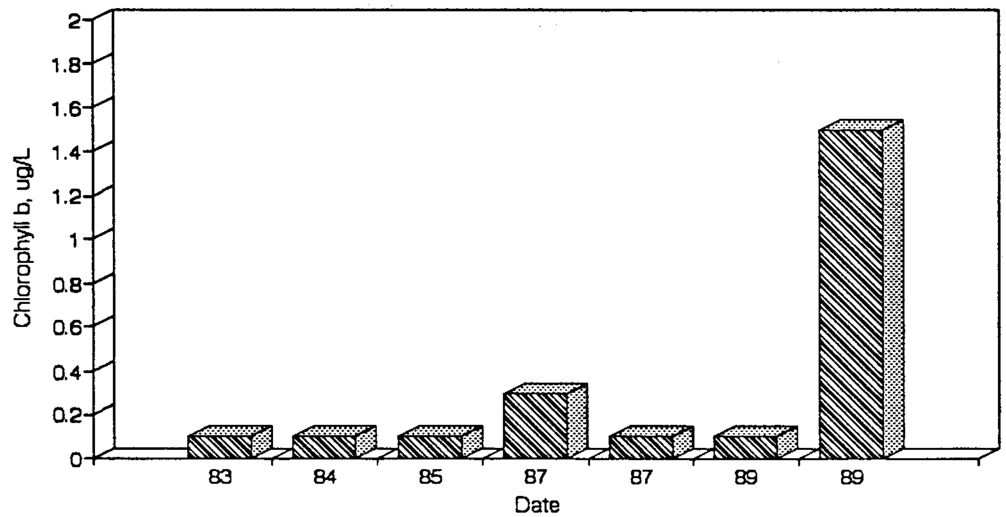

Figure C12. Graph of Chlorophyll b vs. Time for the Ashley Creek Site-Dec.

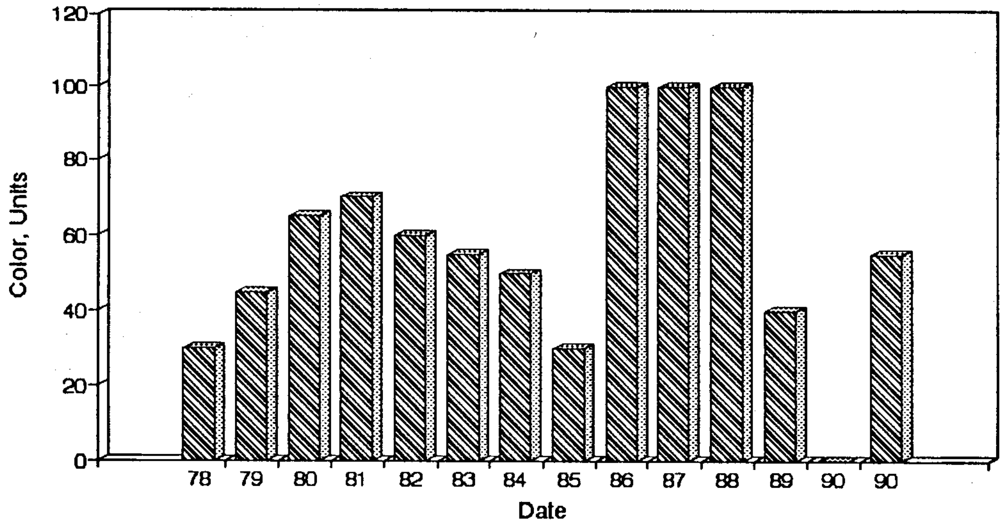

Figure C13. Graph of Color vs. Time for the Ashley Creek Site-May.

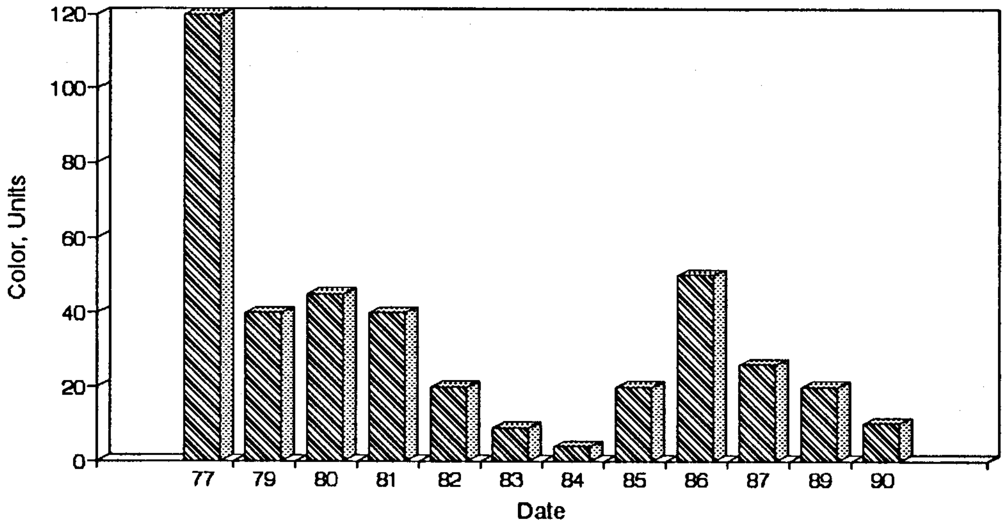

Figure C14. Graph of Color vs. Time for the Ashley Creek Site-Aug.

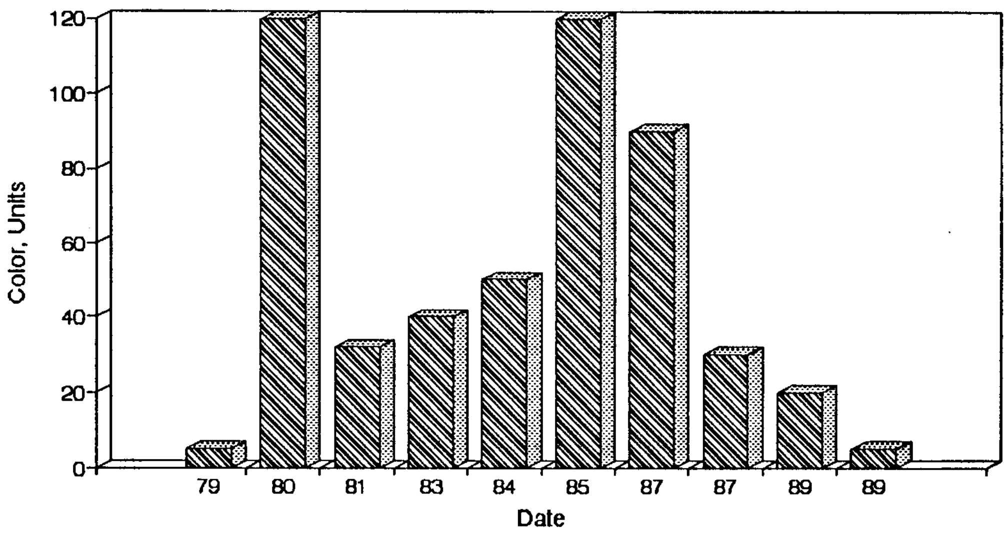

Figure C15. Graph of Color vs. Time for the Ashley Creek Site-Dec.

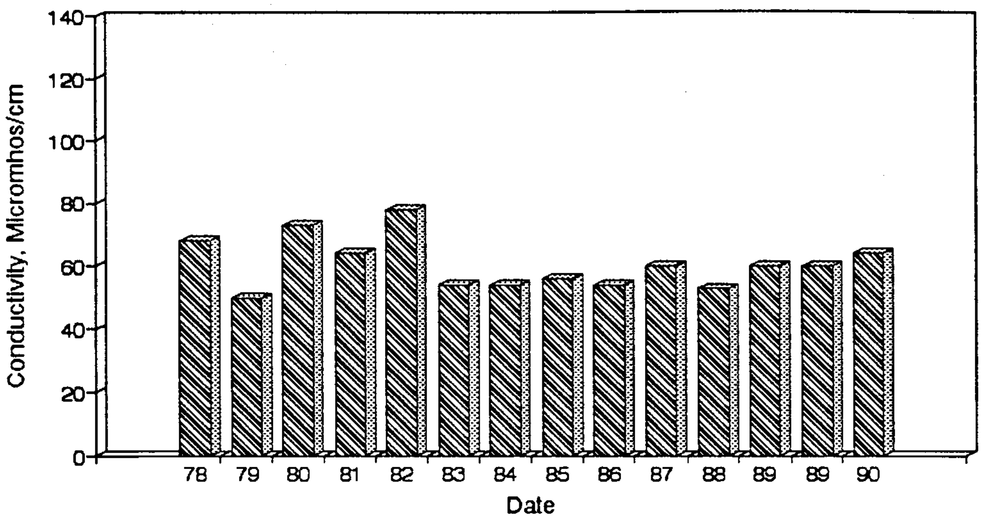

Figure C16. Graph of Conductivity vs. Time for the Ashley Creek Site-May.

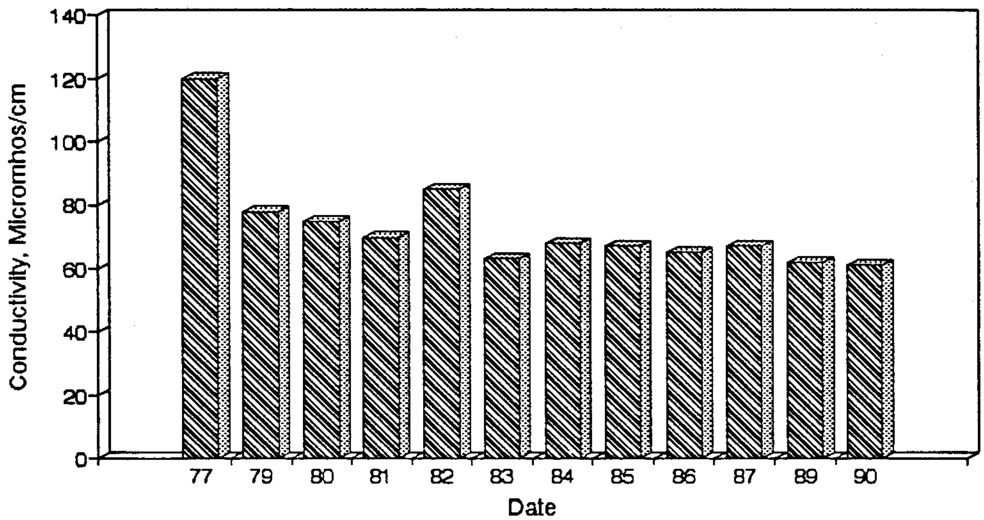

Figure C17. Graph of Conductivity vs. Time for the Ashley Creek Site-Aug.

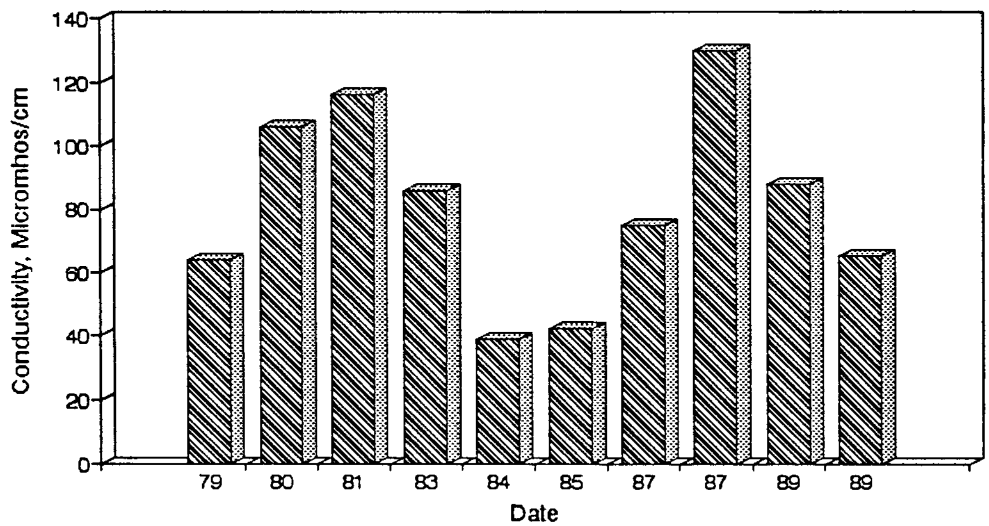

Figure C18. Graph of Conductivity vs. Time for the Ashley Creek Site-Dec.

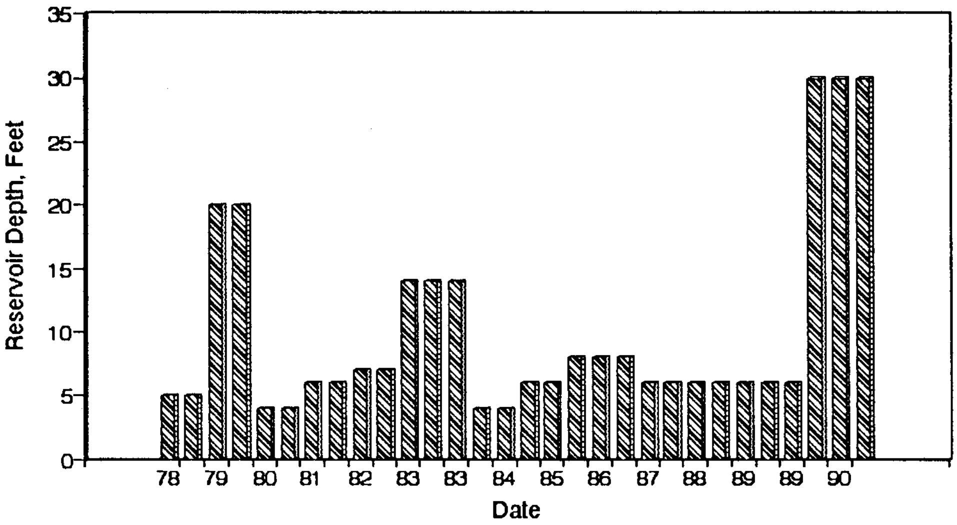

Figure C19. Graph of Reservoir Depth vs. Time for the Ashley Creek Site-May.

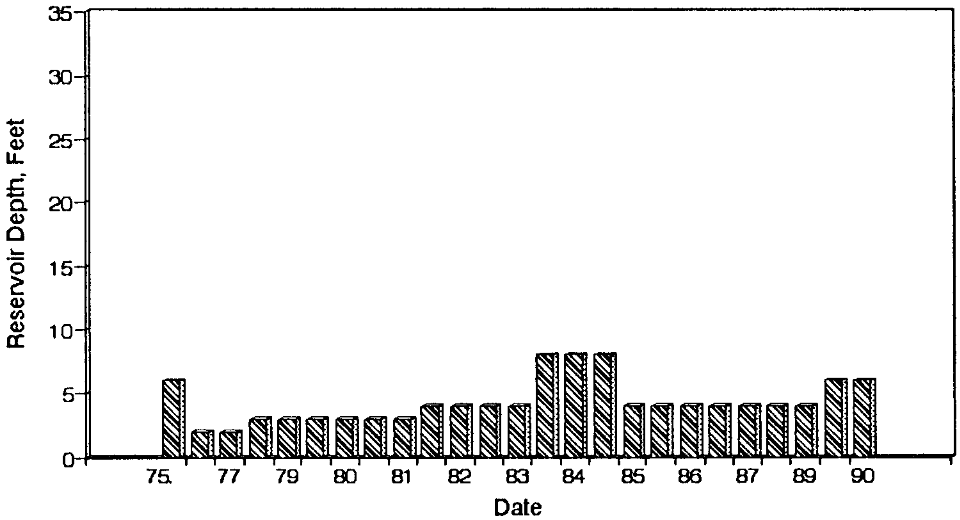

Figure C20. Graph of Reservoir Depth vs. Time for the Ashley Creek Site-Aug.

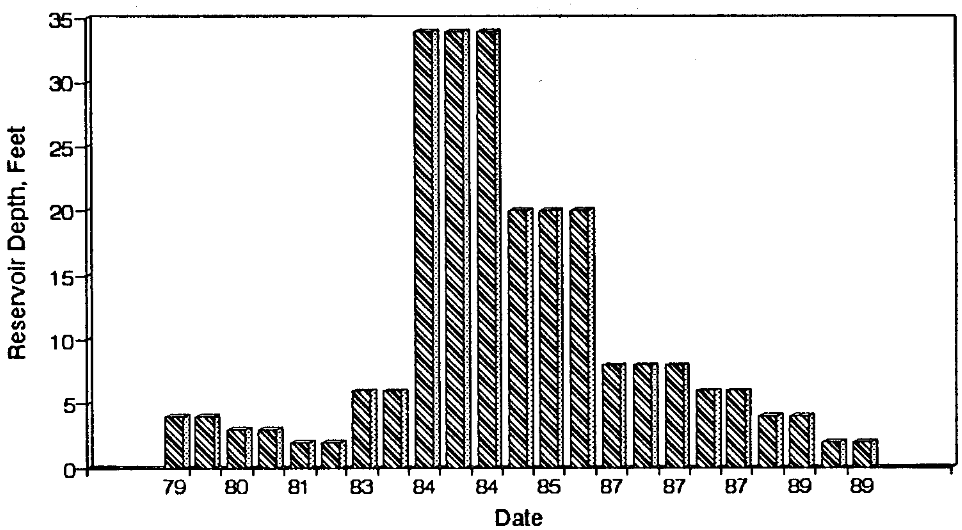

Figure C21. Graph of Reservoir Depth vs. Time for the Ashley Creek Site-Dec.

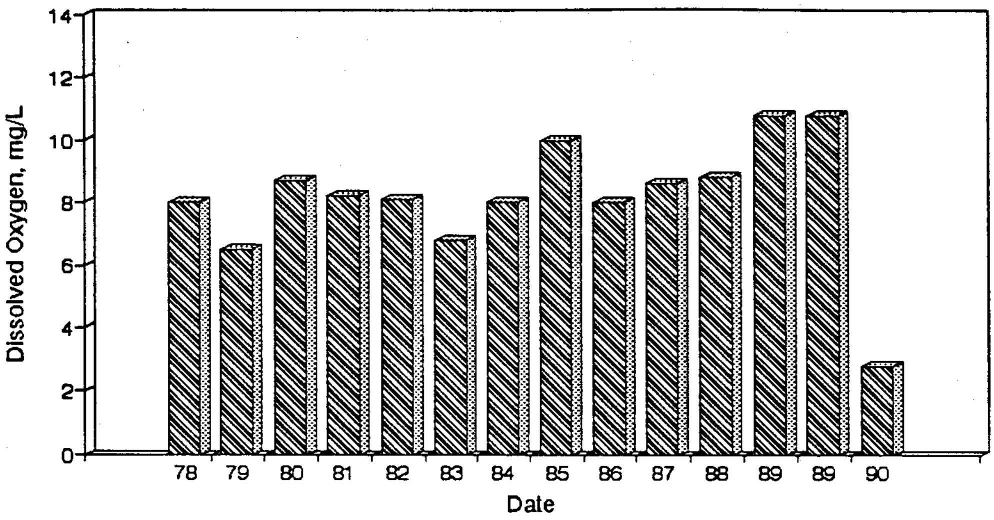

Figure C22. Graph of Dissolved Oxygen vs. Time for the Ashley Creek Site-May.

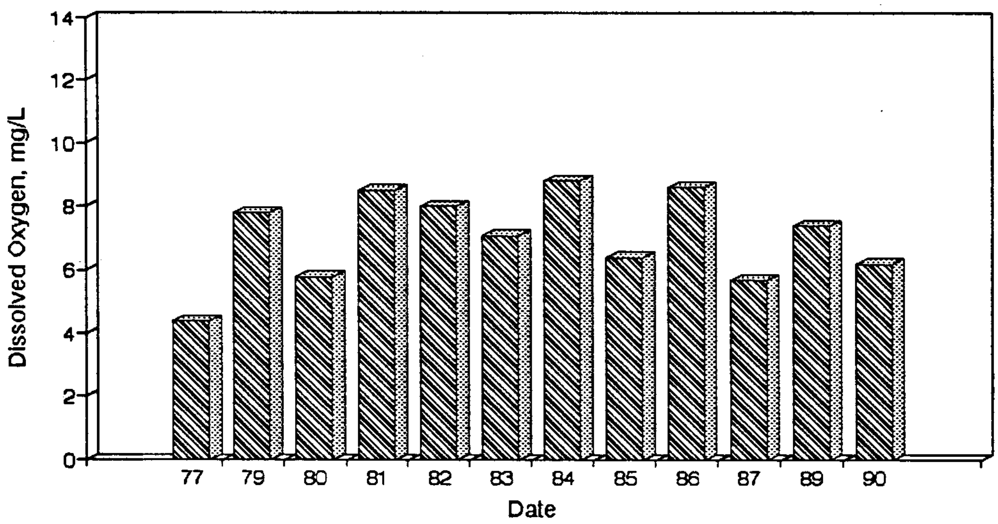

Figure C23. Graph of Dissolved Oxygen vs. Time for the Ashley Creek Site-Aug.

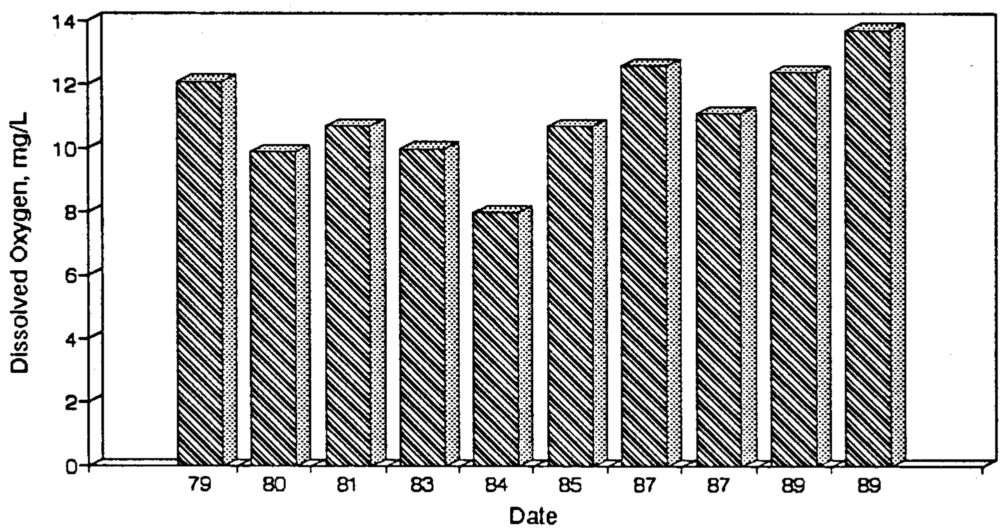

Figure C24. Graph of Dissolved Oxygen vs. Time for the Ashley Creek Site-Dec.

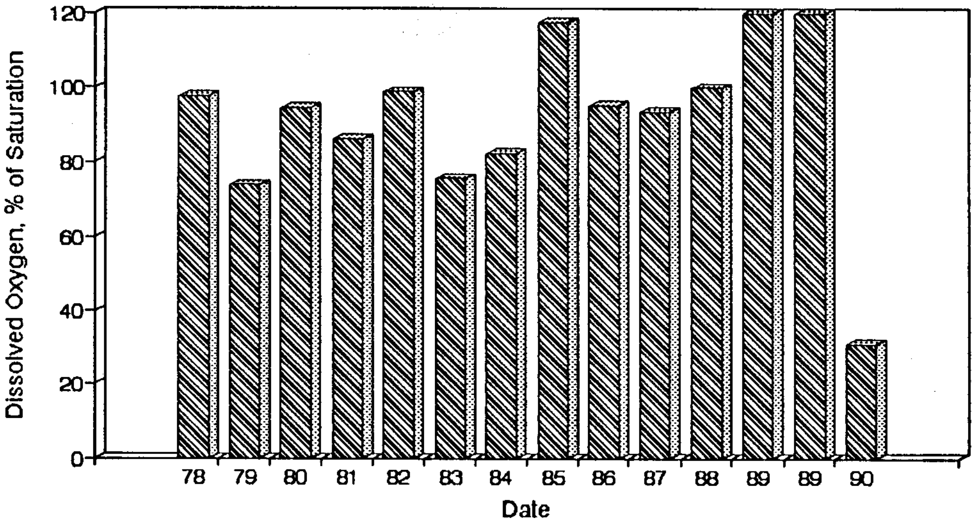

Figure C25. Graph of Dissolved Oxygen vs. Time for the Ashley Creek Site-May.

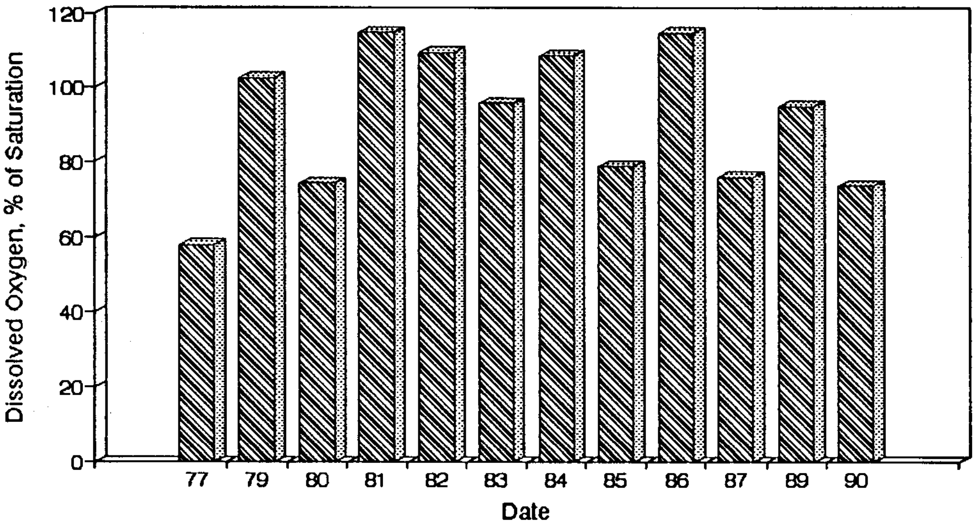

Figure C26. Graph of Dissolved Oxygen vs. Time for the Ashley Creek Site-Aug.

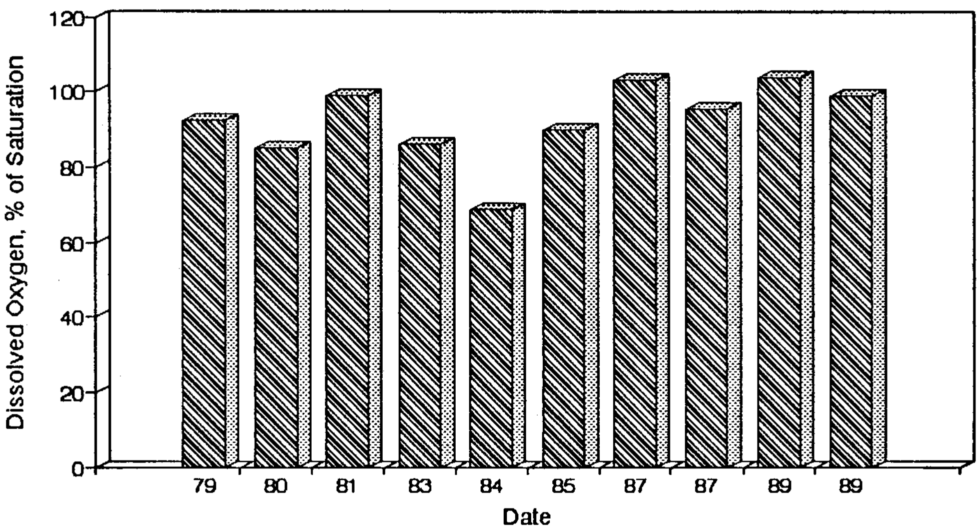

Figure C27. Graph of Dissolved Oxygen vs. Time for the Ashley Creek Site-Dec.

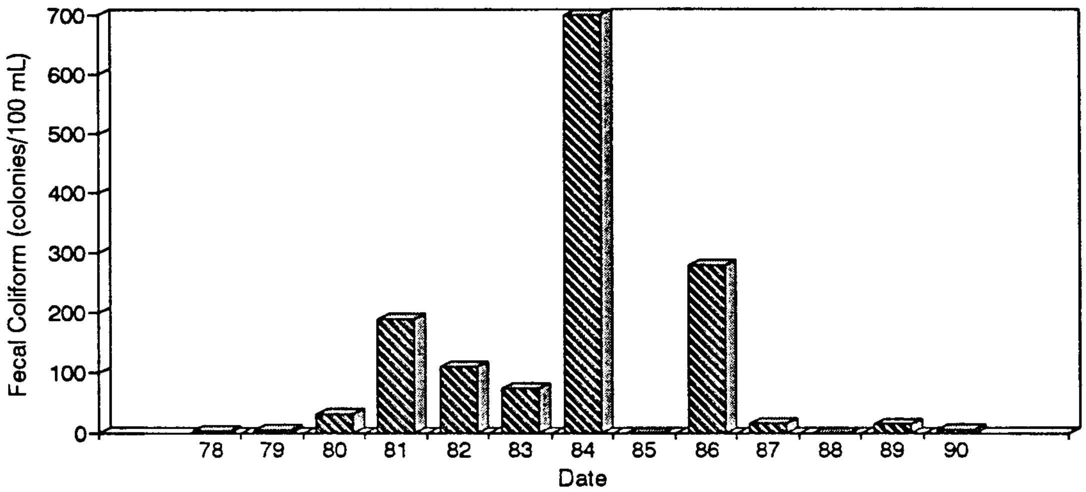

Figure C28. Graph of Fecal Coliform vs. Time for the Ashley Creek Site-May.

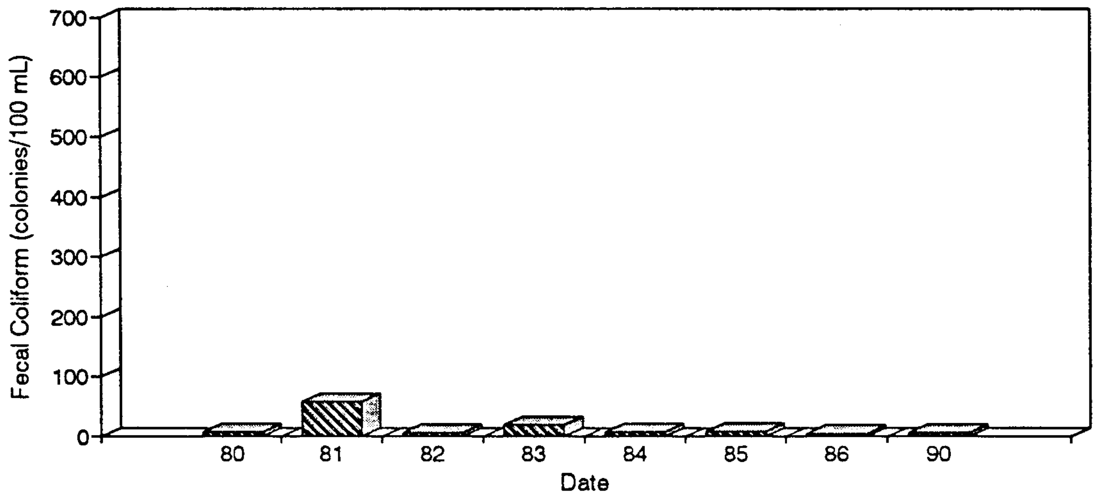

Figure C29. Graph of Fecal Coliform vs. Time for the Ashley Creek Site-Aug.

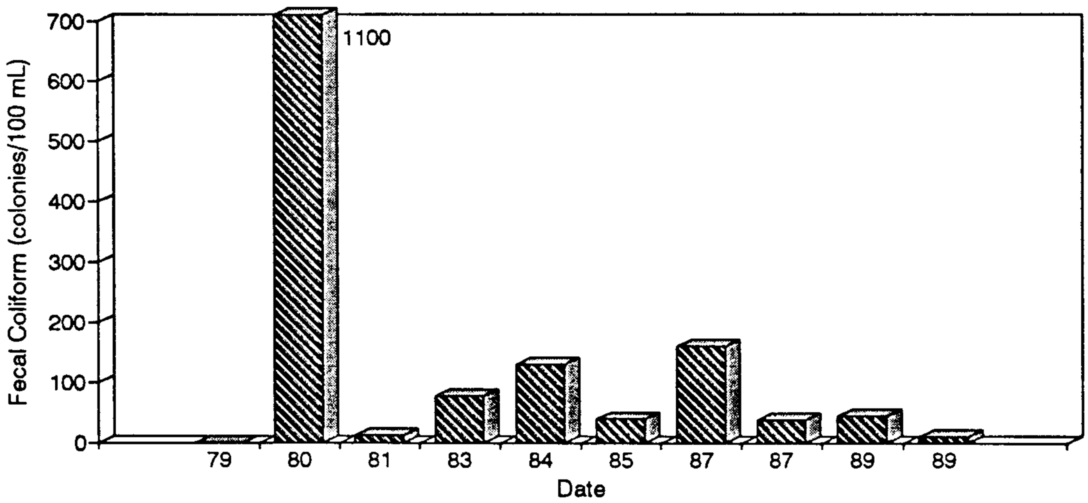

Figure C30. Graph of Fecal Coliform vs. Time for the Ashley Creek Site-Dec.

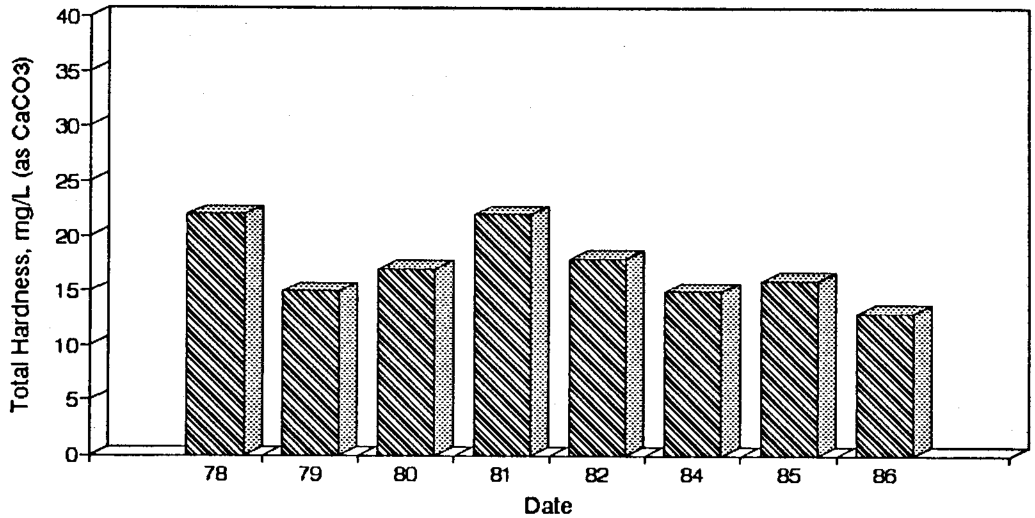

Figure C31. Graph of Total Hardness vs. Time for the Ashley Creek Site-May.

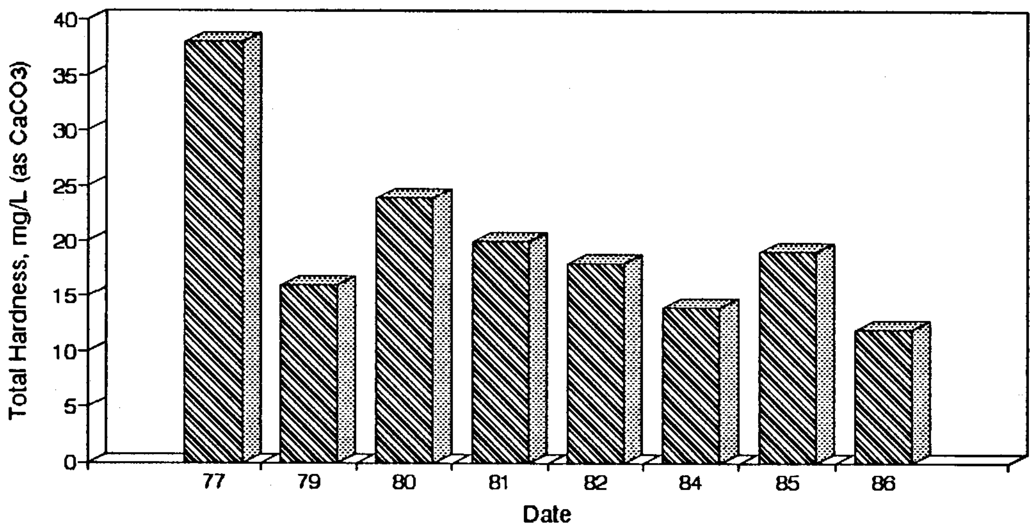

Figure C32. Graph of Total Hardness vs. Time for the Ashley Creek Site-Aug.

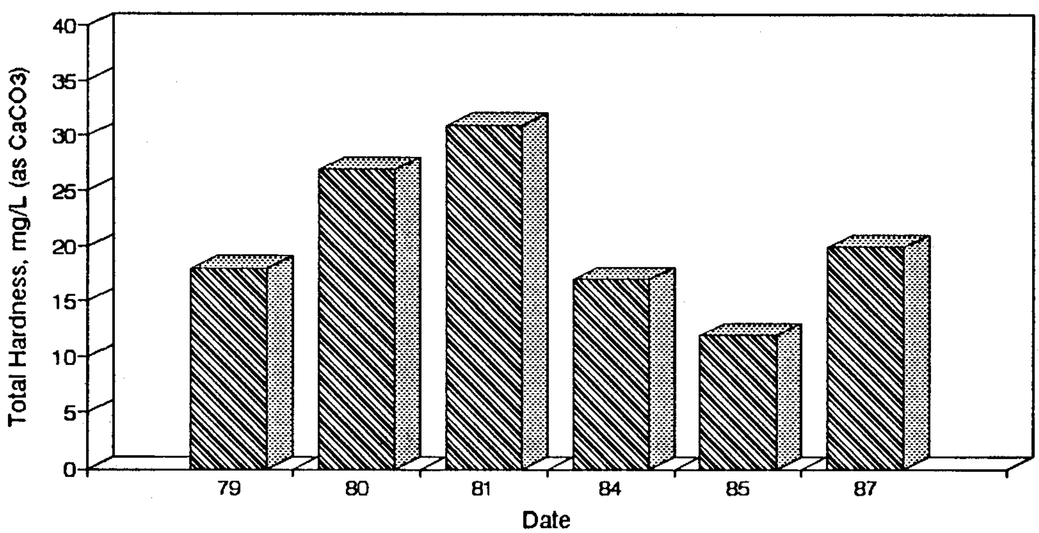

Figure C33. Graph of Total Hardness vs. Time for the Ashley Creek Site-Dec.

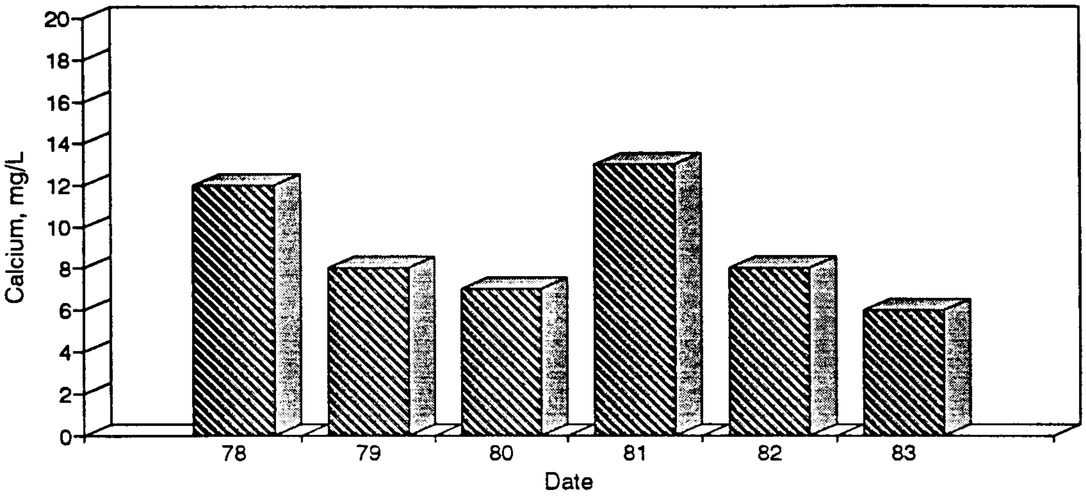

Figure C34. Graph of Calcium vs. Time for the Ashley Creek Site-May.

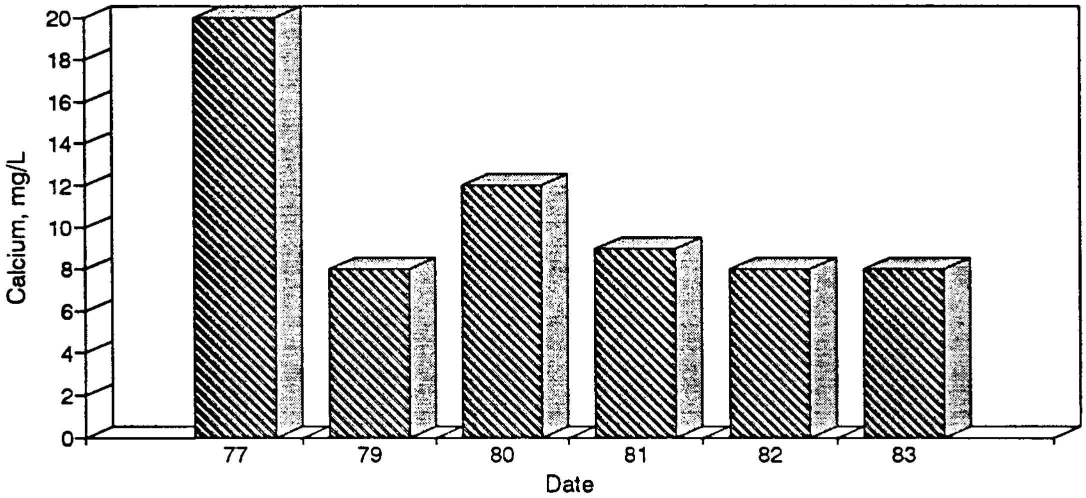

Figure C35. Graph of Calcium vs. Time for the Ashley Creek Site-Aug.

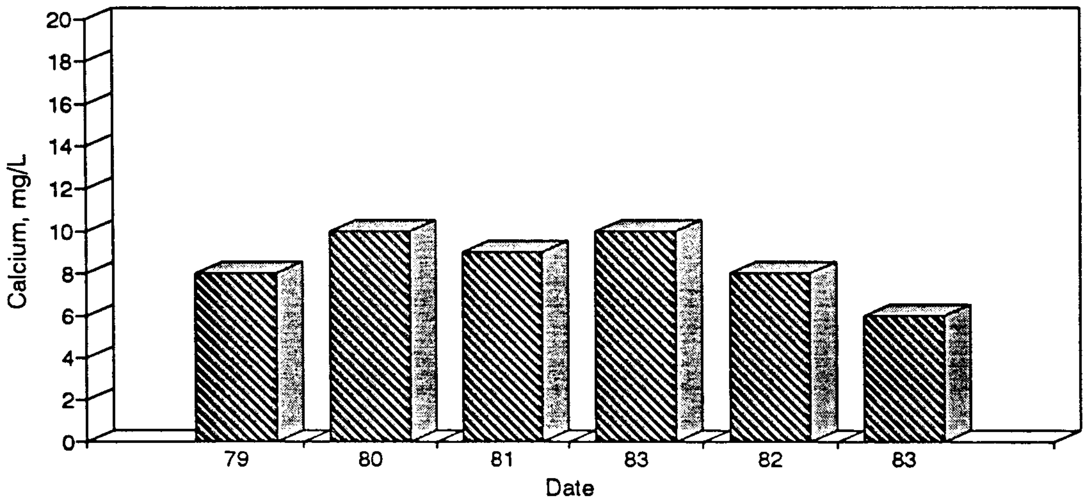

Figure C36. Graph of Calcium vs. Time for the Ashley Creek Site-Dec.

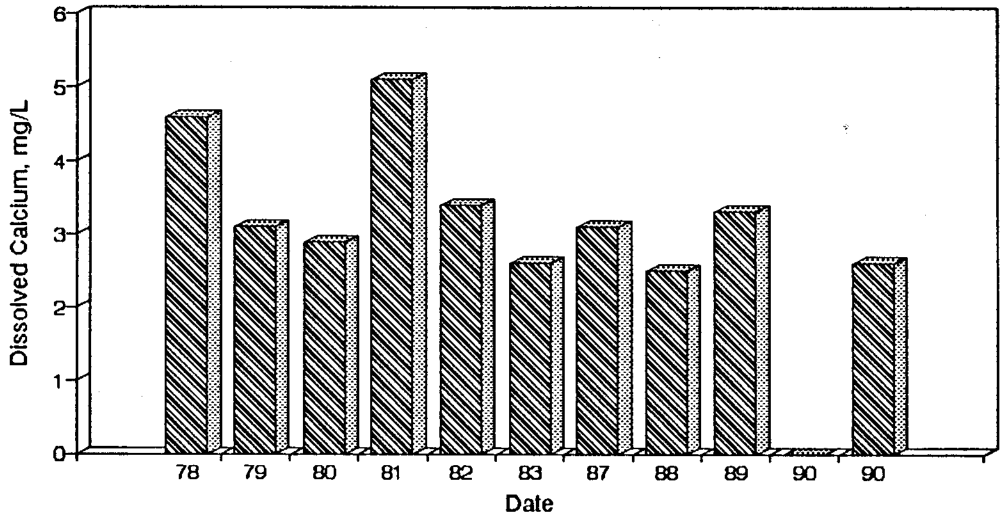

Figure C37. Graph of Dissolved Calcium vs. Time for the Ashley Creek Site-May.

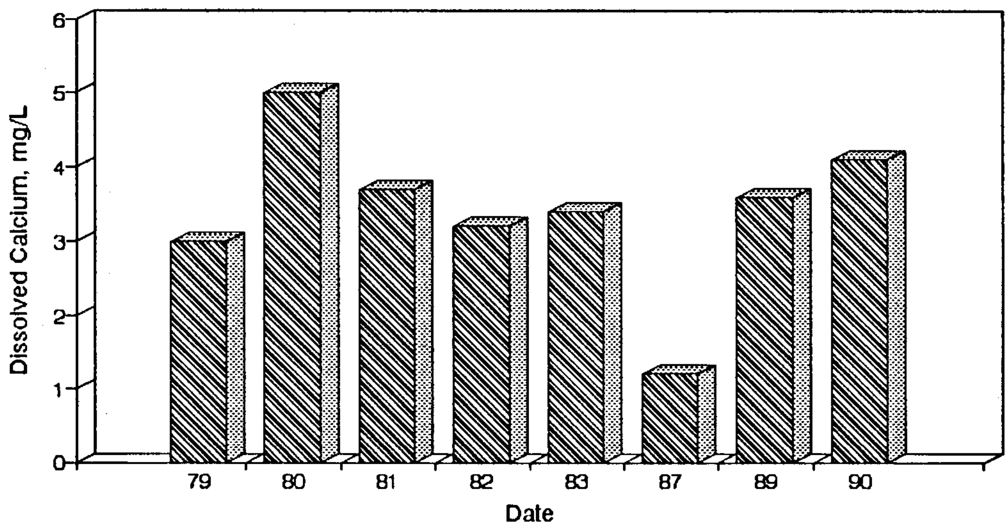

Figure C38. Graph of Dissolved Calcium vs. Time for the Ashley Creek Site-Aug.

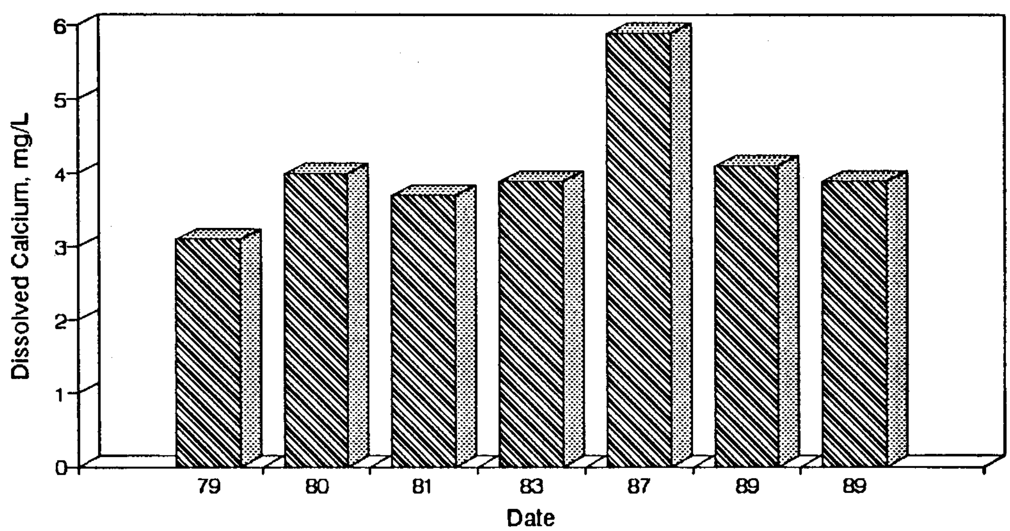

Figure C39. Graph of Dissolved Calcium vs. Time for the Ashley Creek Site-Dec.

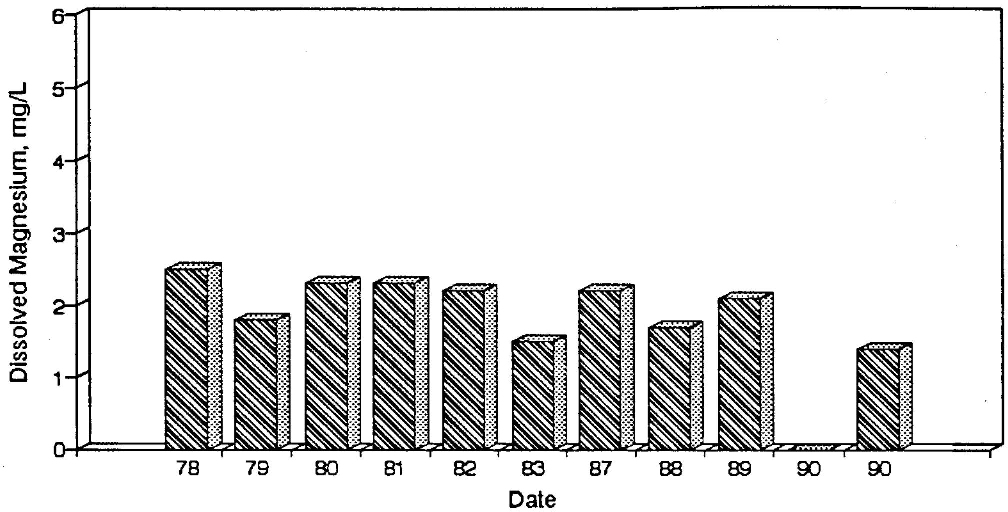

Figure C40. Graph of Dissolved Magnesium vs. Time for the Ashley Creek Site-May.

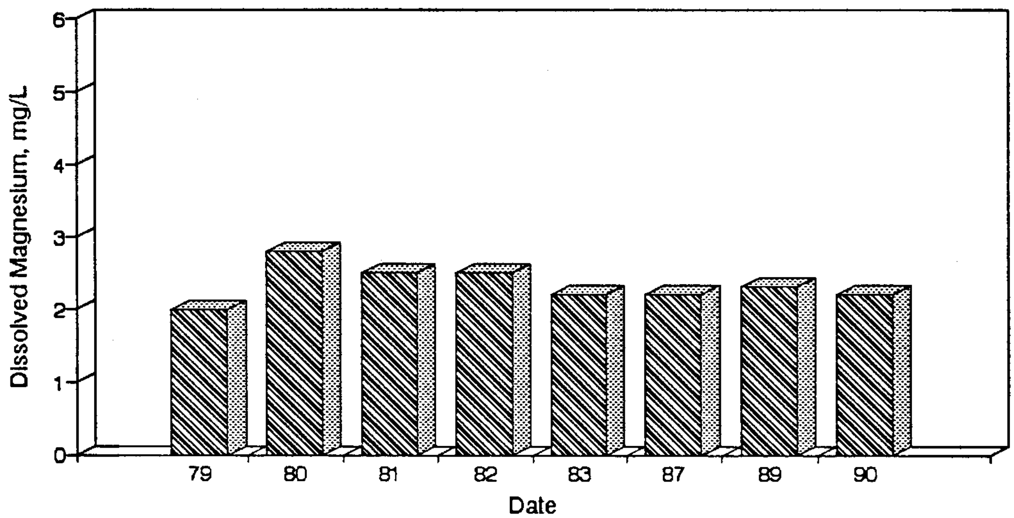

Figure C41. Graph of Dissolved Magnesium vs. Time for the Ashley Creek Site-Aug.

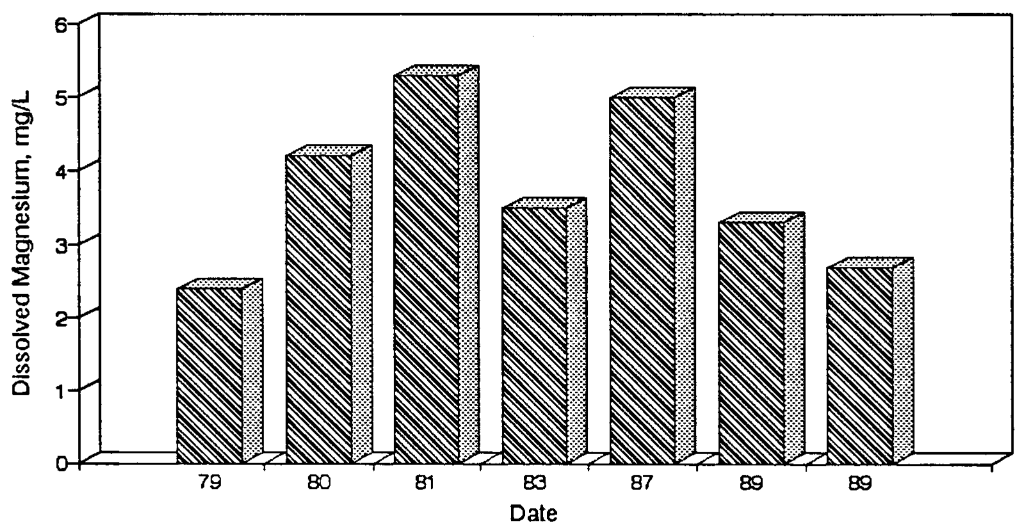

Figure C42. Graph of Dissolved Magnesium vs. Time for the Ashley Creek Site-Dec.

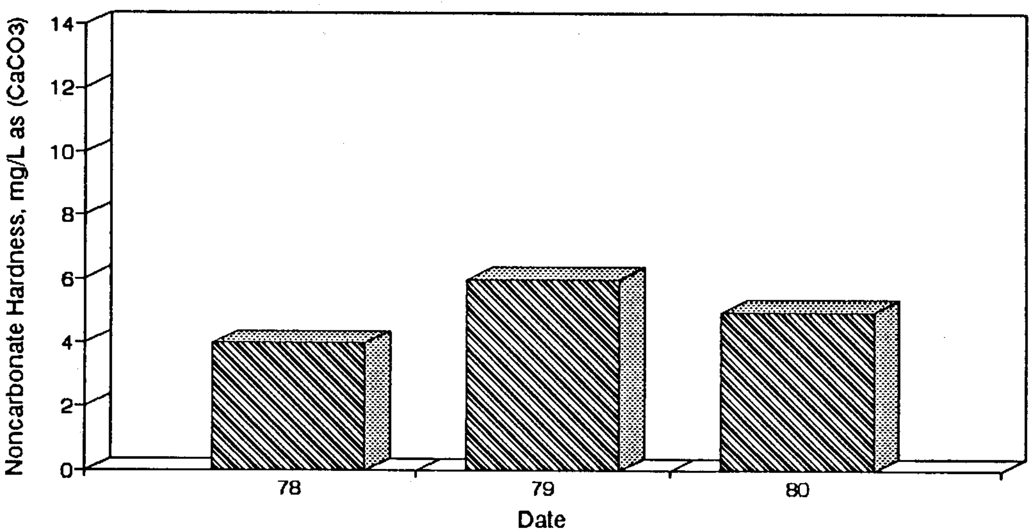

Figure C43. Graph of Noncarbonate Hardness vs. Time for the Ashley Creek Site-May.

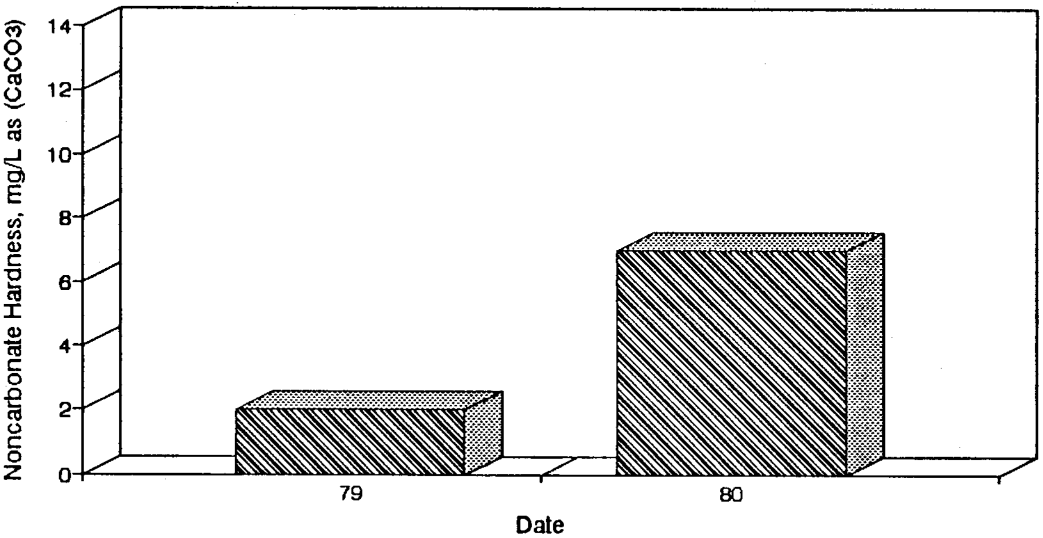

Figure C44. Graph of Noncarbonate Hardness vs. Time for the Ashley Creek Site-Aug.

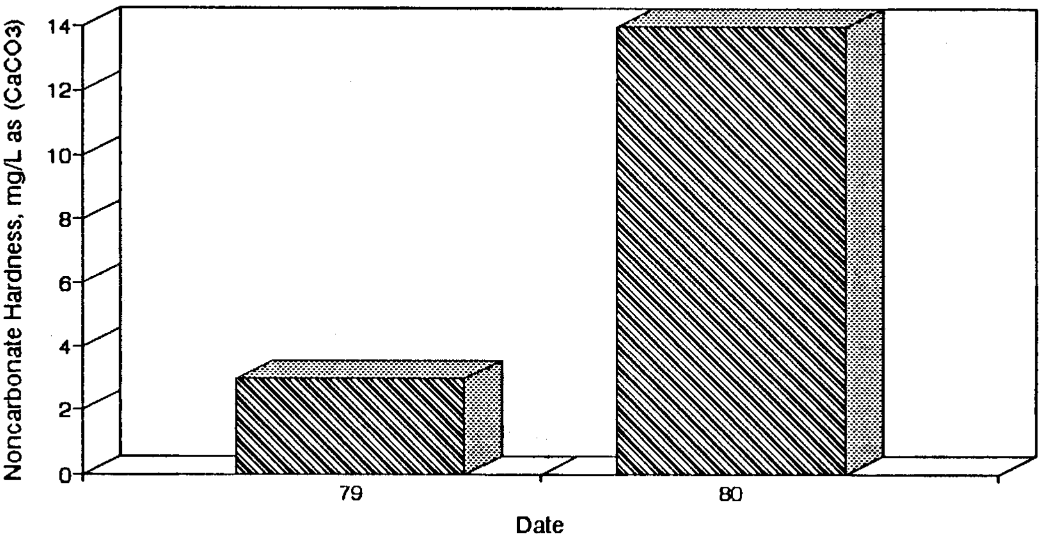

Figure C45. Graph of Noncarbonate Hardness vs. Time for the Ashley Creek Site-Dec.

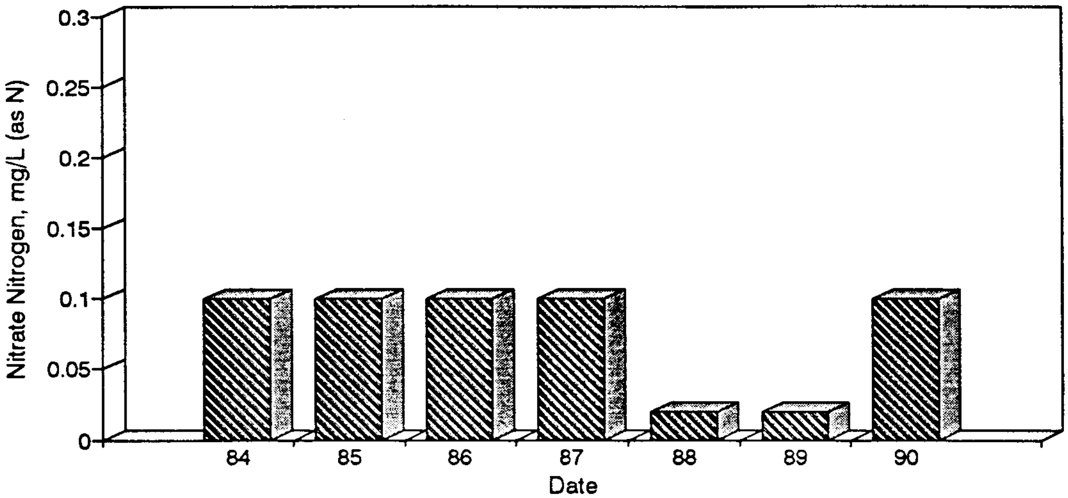

Figure C46. Graph of Nitrate Nitrogen vs. Time for the Ashley Creek Site-May.

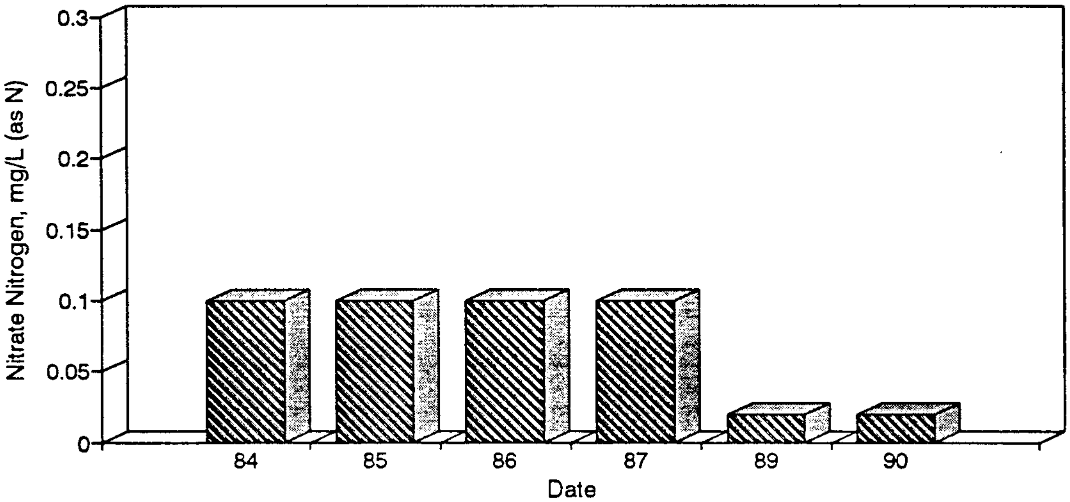

Figure C47. Graph of Nitrate Nitrogen vs. Time for the Ashley Creek Site-Aug.

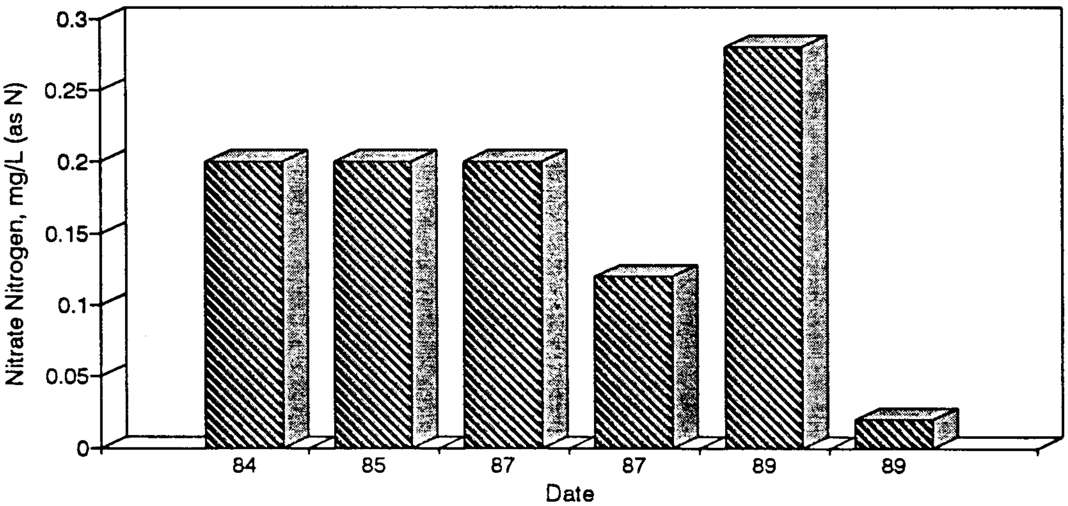

Figure C48. Graph of Nitrate Nitrogen vs. Time for the Ashley Creek Site-Dec.

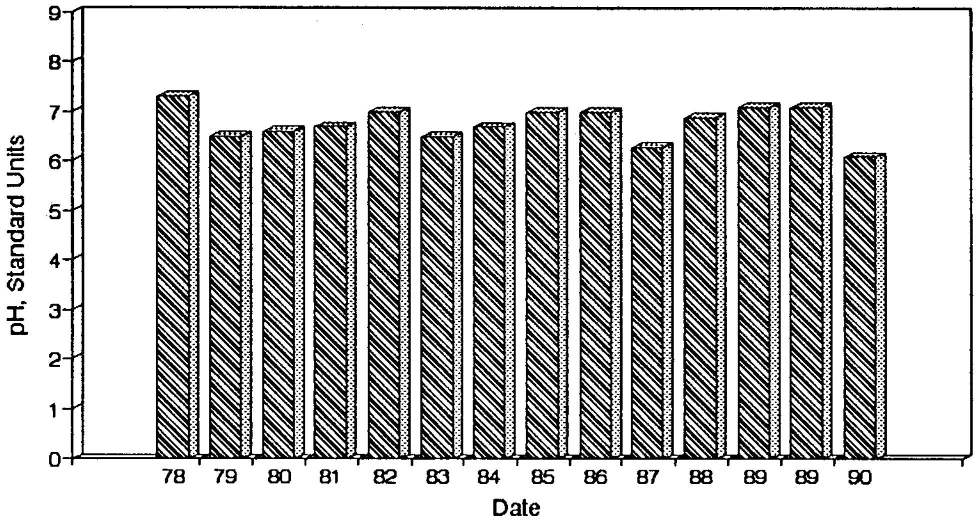

Figure C49. Graph of pH vs. Time for the Ashley Creek Site-May.

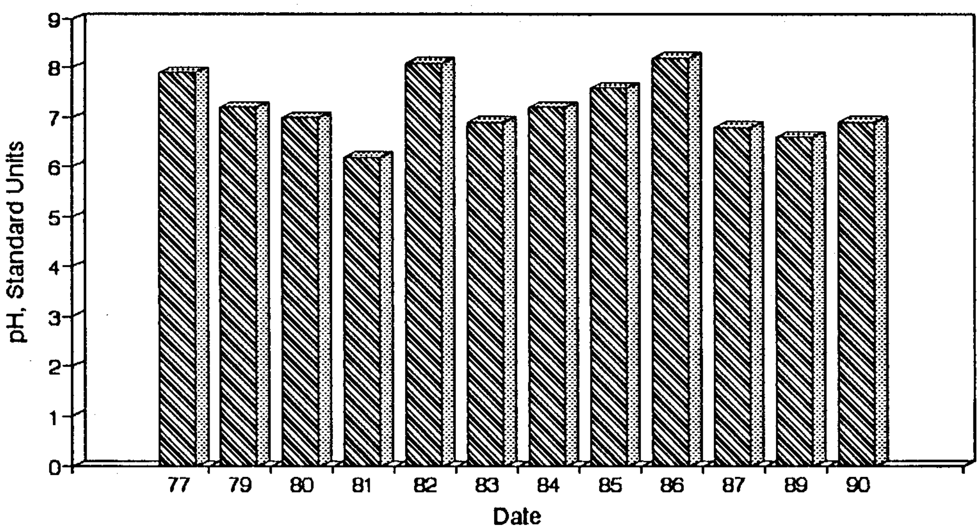

Figure C50. Graph of pH vs. Time for the Ashley Creek Site-Aug.

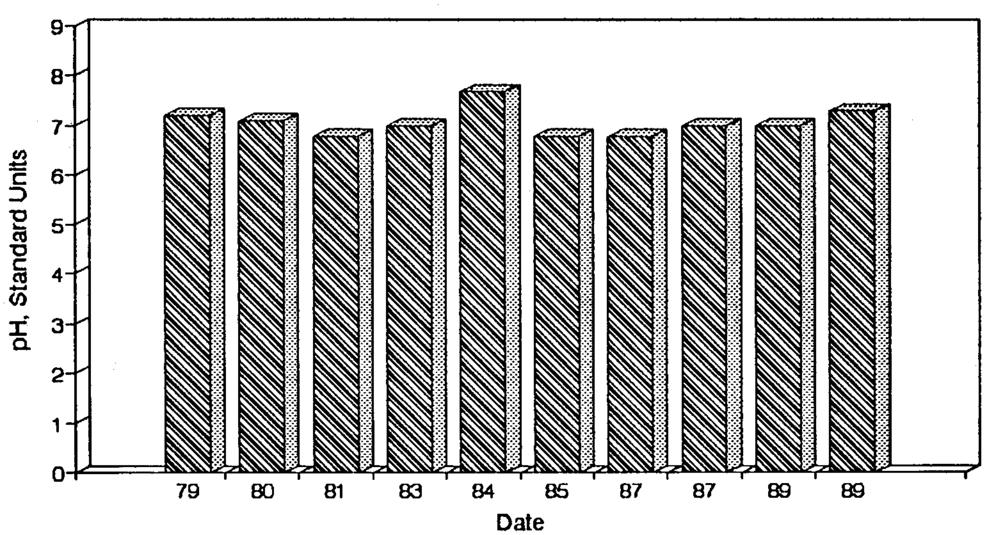

Figure C51. Graph of pH vs. Time for the Ashley Creek Site-Dec.

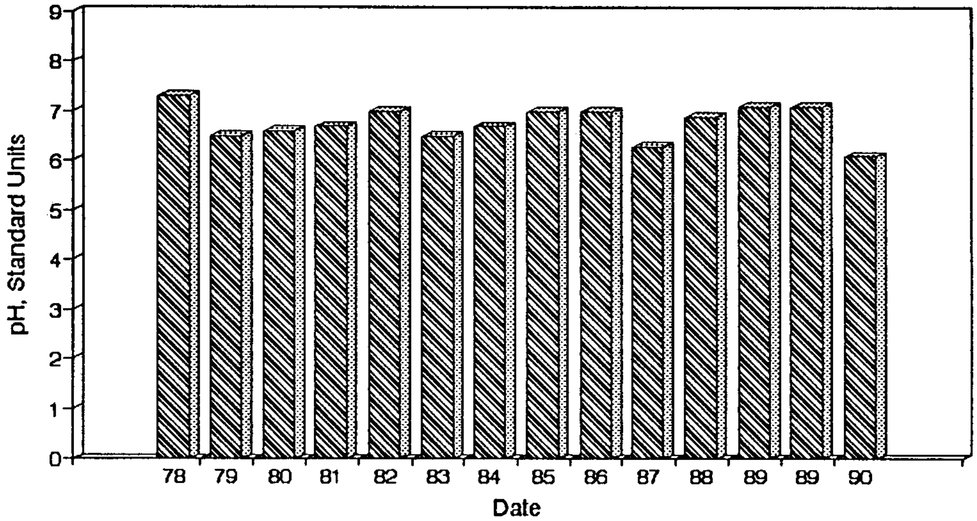

Figure C49. Graph of pH vs. Time for the Ashley Creek Site-May.

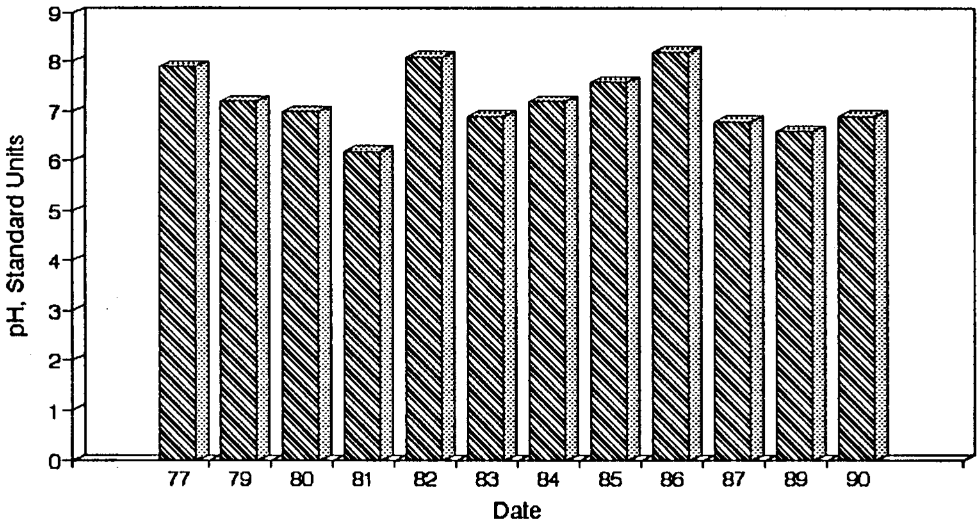

Figure C50. Graph of pH vs. Time for the Ashley Creek Site-Aug.

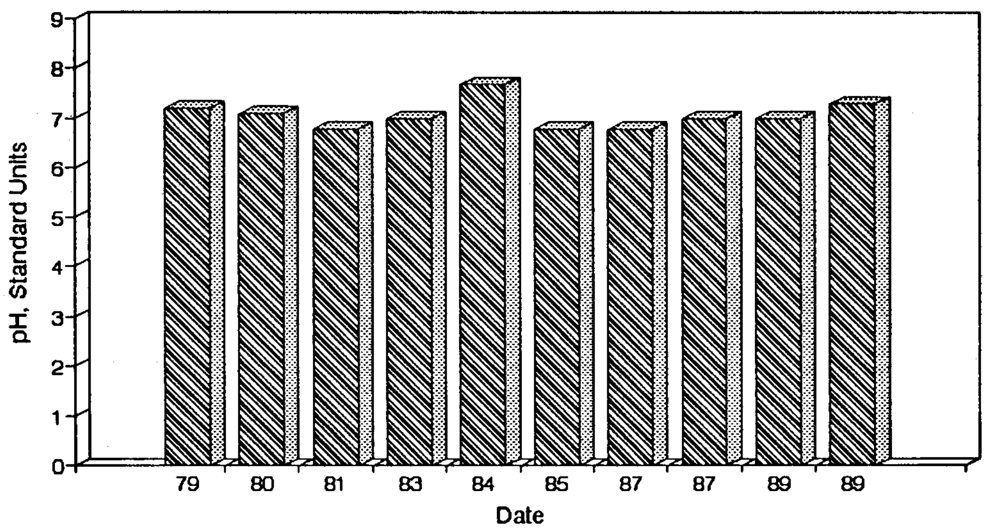

Figure C51. Graph of pH vs. Time for the Ashley Creek Site-Dec.

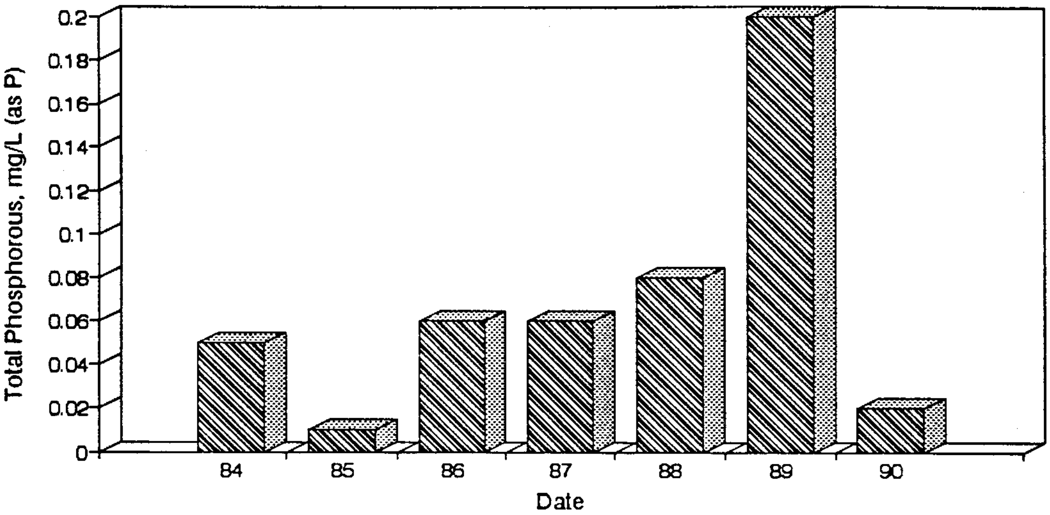

Figure C52. Graph of Total Phosphorous vs. Time for the Ashley Creek Site-May.

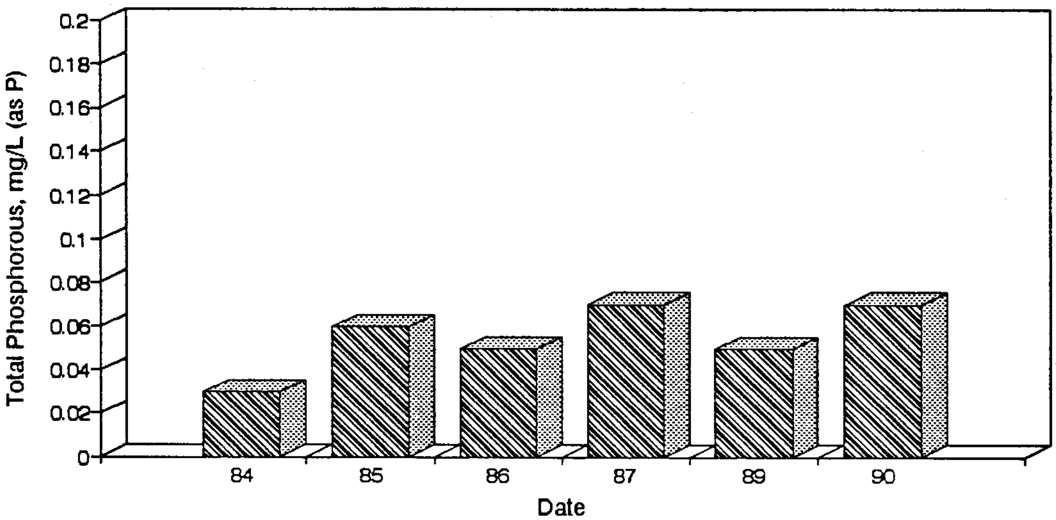

Figure C53. Graph of Total Phosphorous vs. Time for the Ashley Creek Site-Aug.

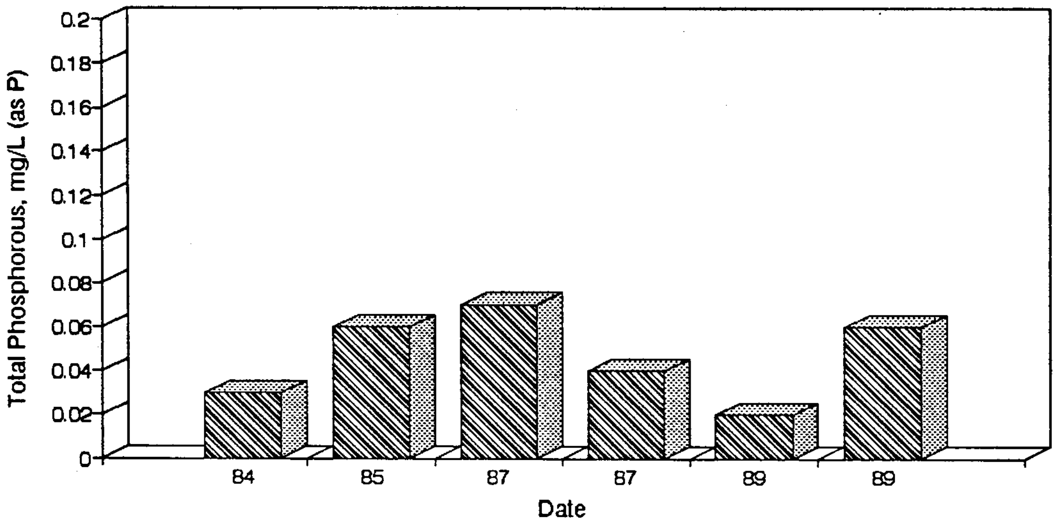

Figure C54. Graph of Total Phosphorous vs. Time for the Ashley Creek Site-Dec.

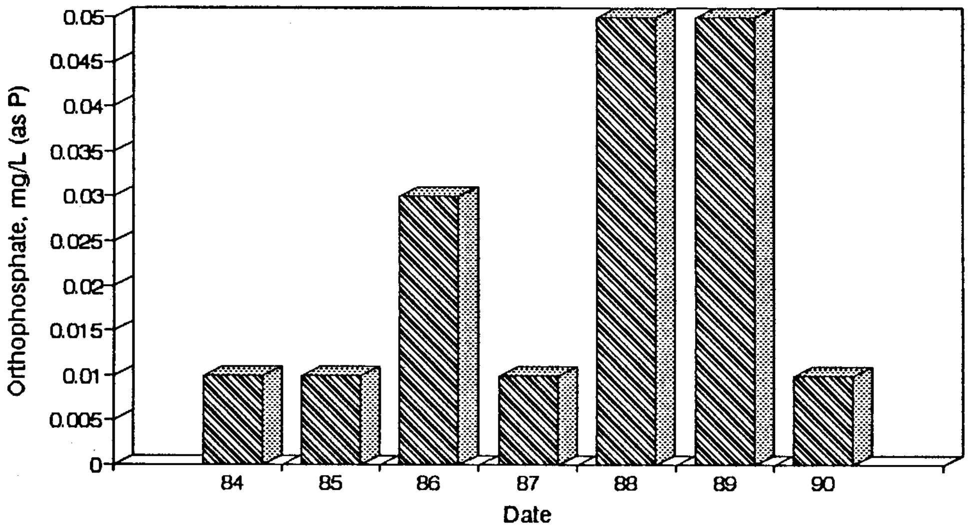

Figure C55. Graph of Orthophosphate vs. Time for the Ashley Creek Site-May.

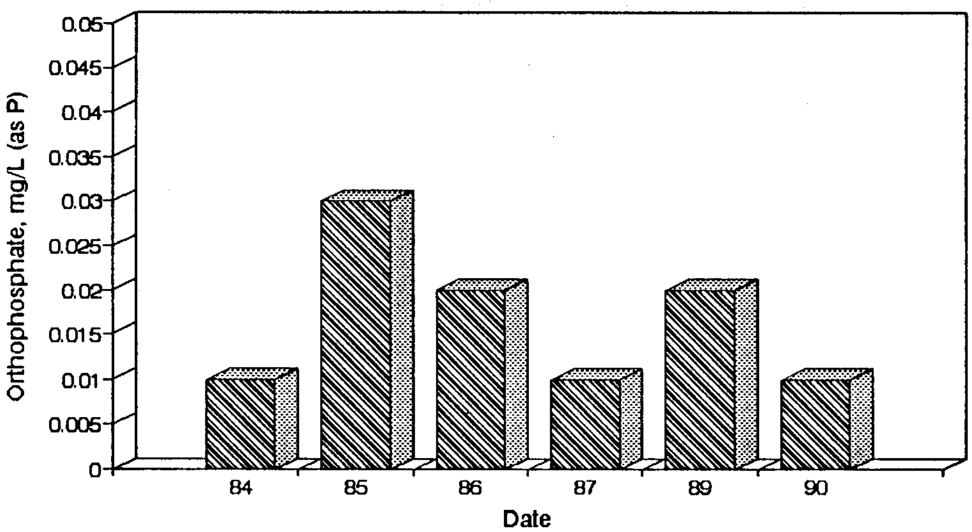

Figure C56. Graph of Orthophosphate vs. Time for the Ashley Creek Site-Aug.

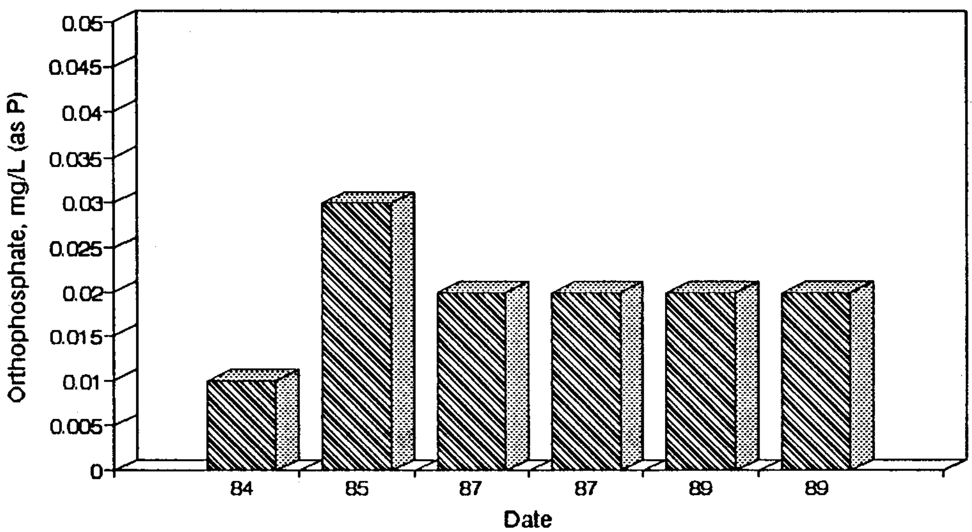

Figure C57. Graph of Orthophosphate vs. Time for the Ashley Creek Site-Dec.

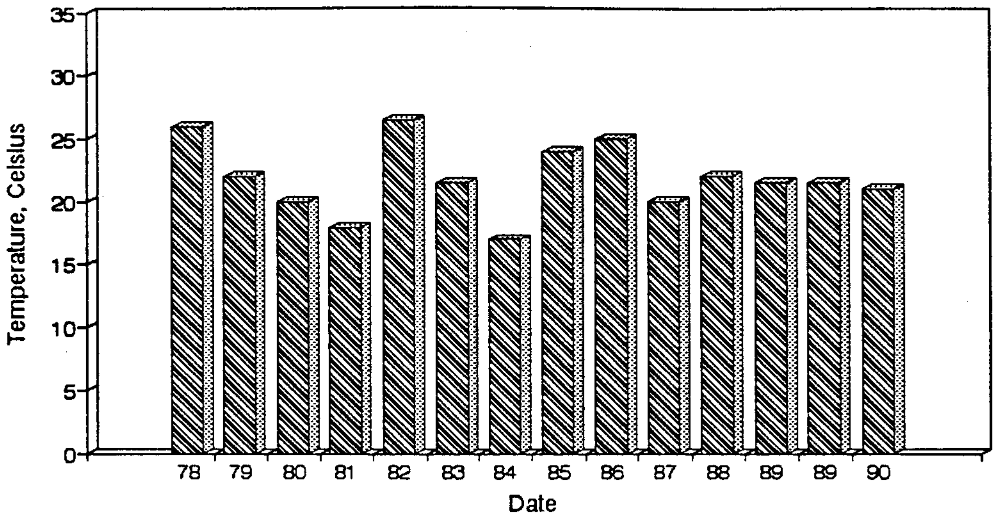

Figure C58. Graph of Temperature vs. Time for the Ashley Creek Site-May.

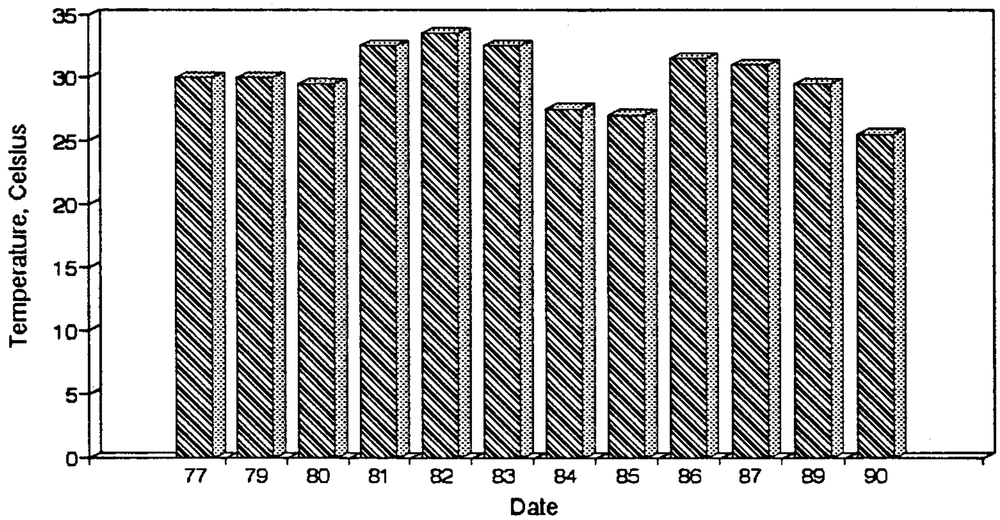

Figure C59. Graph of Temperature vs. Time for the Ashley Creek Site-Aug.

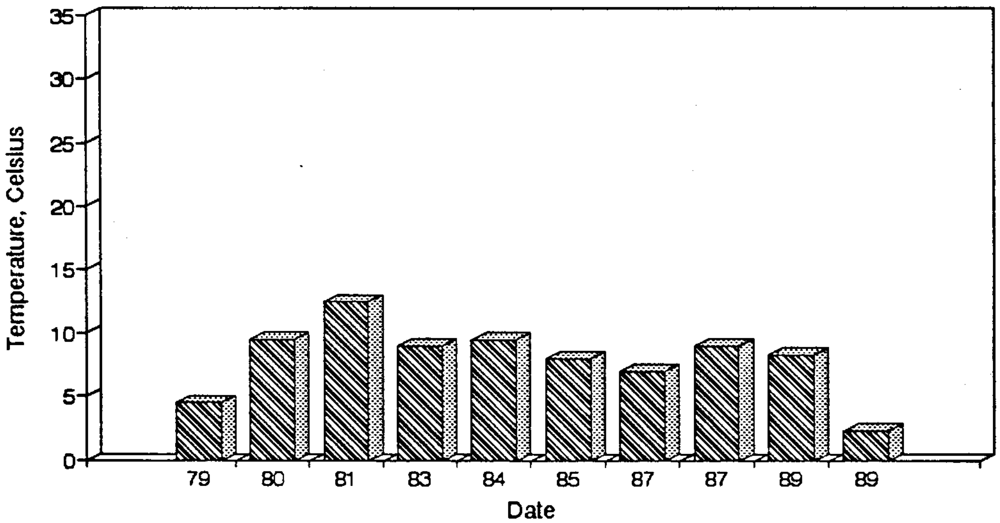

Figure C60. Graph of Temperature vs. Time for the Ashley Creek Site-Dec.

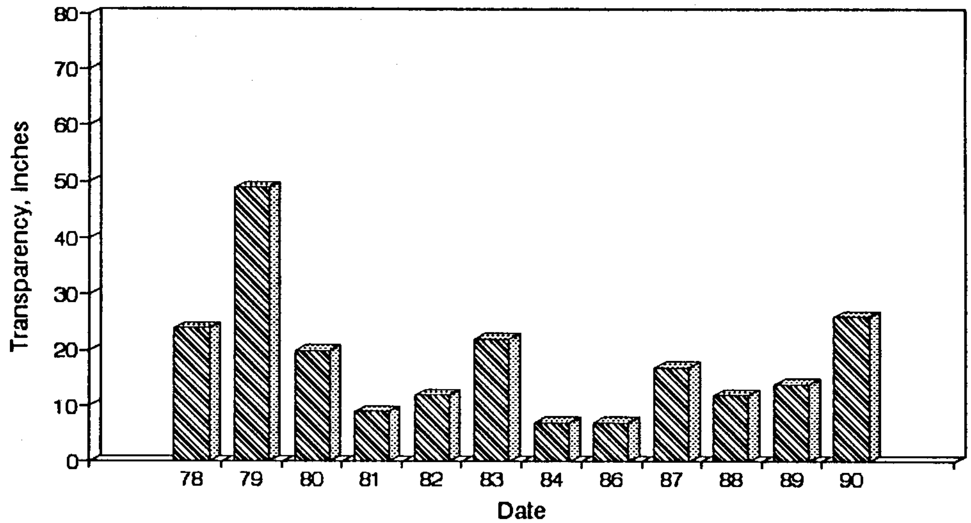

Figure C61. Graph of Transparency vs. Time for the Ashley Creek Site-May.

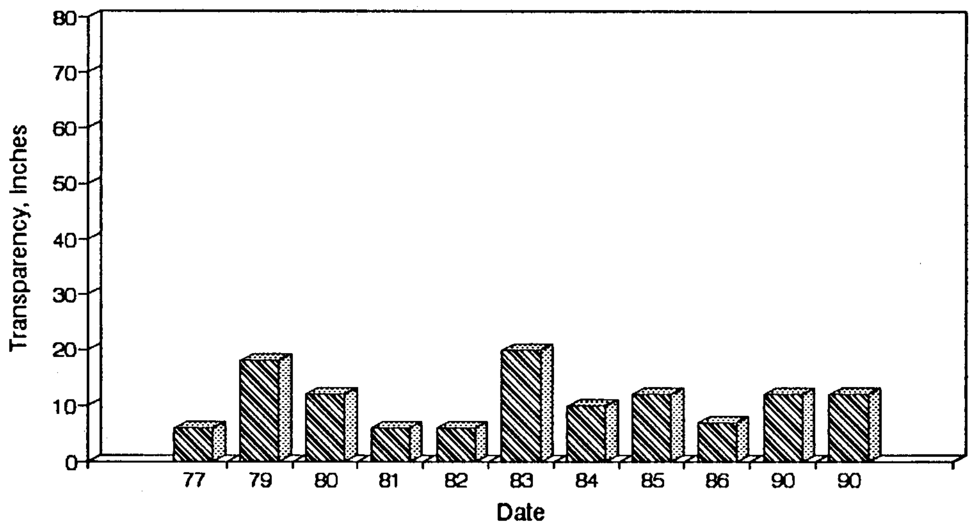

Figure C62. Graph of Transparency vs. Time for the Ashley Creek Site-Aug.

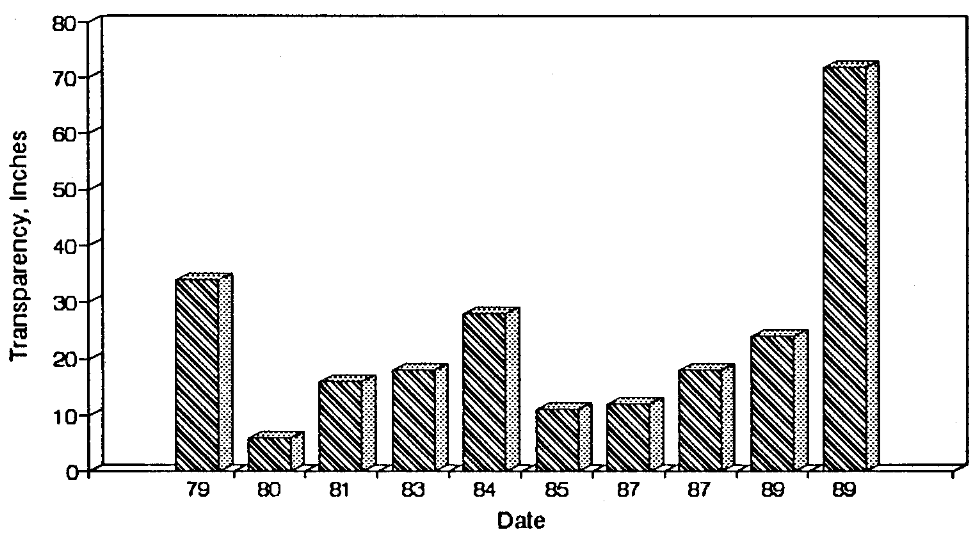

Figure C63. Graph of Transparency vs. Time for the Ashley Creek Site-Dec.

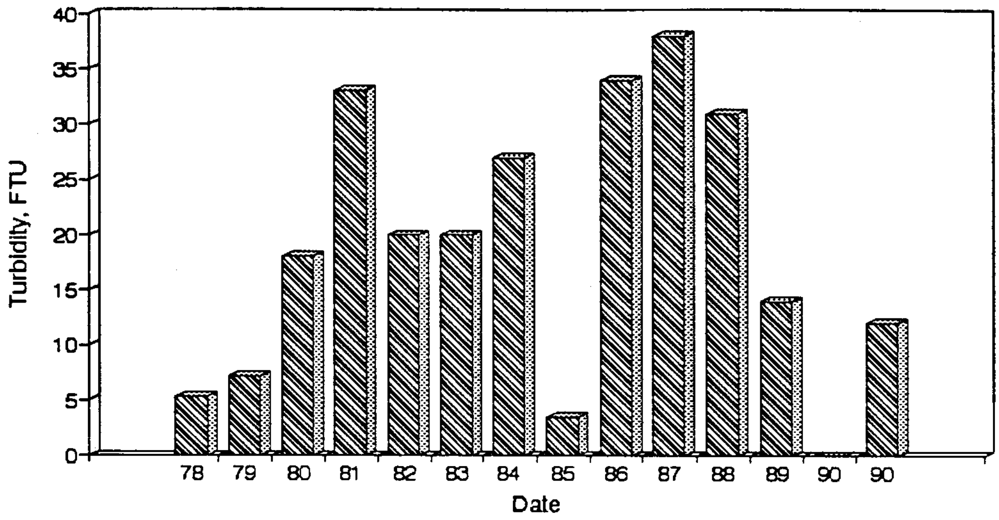

Figure C64. Graph of Turbidity vs. Time for the Ashley Creek Site-May.

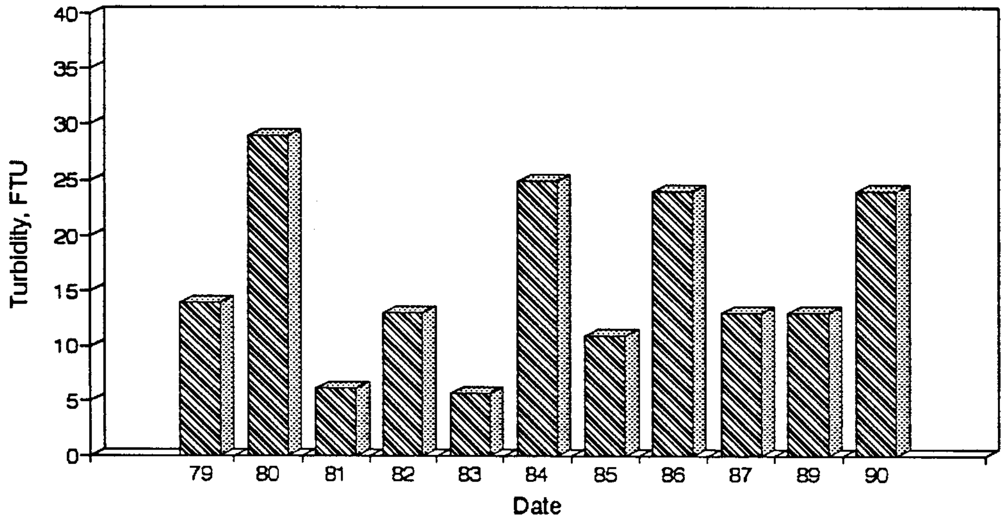

Figure C65. Graph of Turbidity vs. Time for the Ashley Creek Site-Aug.

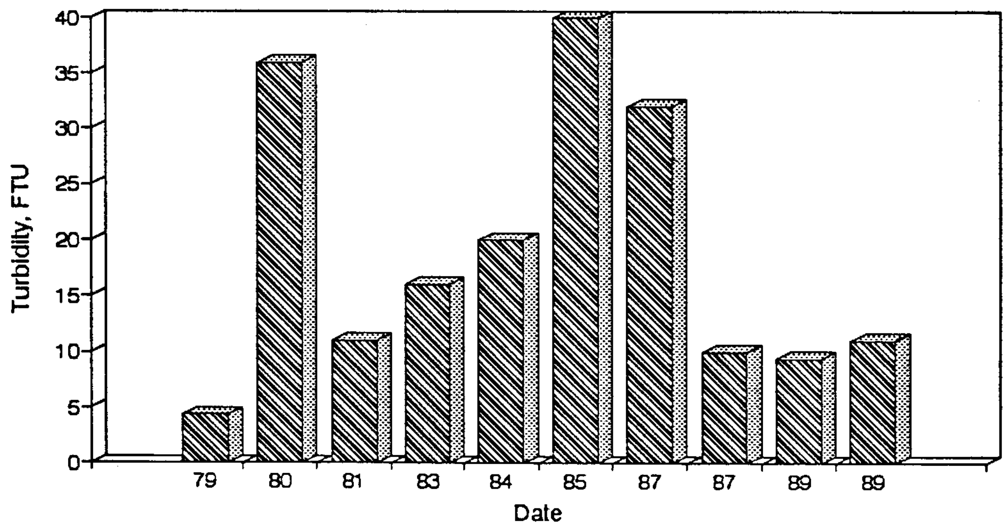

Figure C66. Graph of Turbidity vs. Time for the Ashley Creek Site-Dec.

APPENDIX D

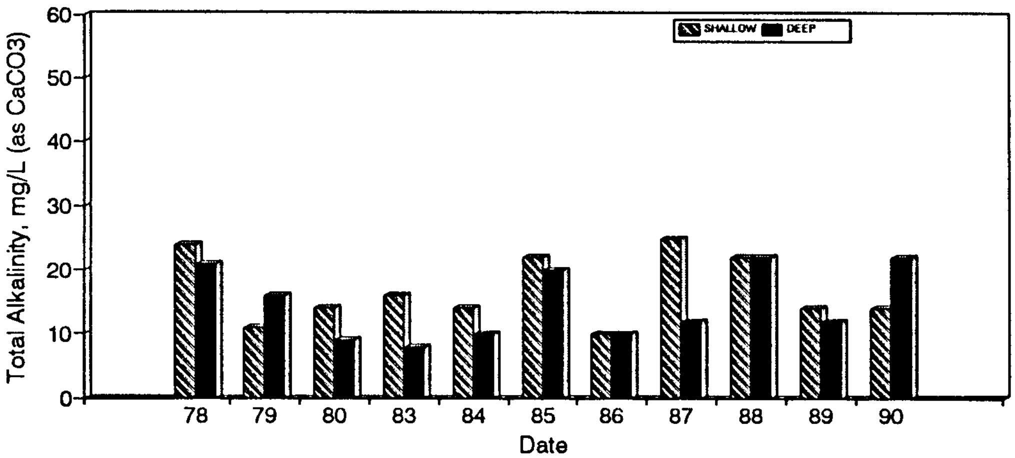

Figure D1. Graph of Total Alkalinity vs. Time for the Hwy109 Site-May.

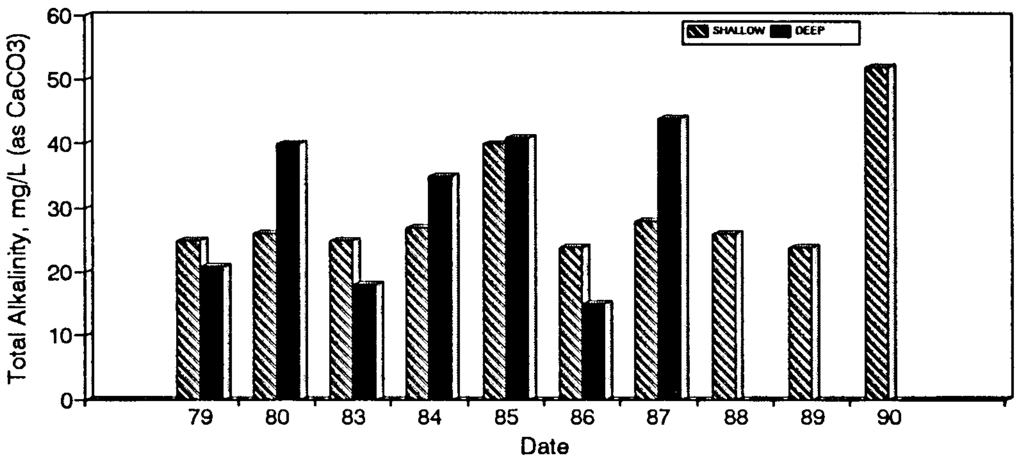

Figure D2. Graph of Total Alkalinity vs. Time for the Hwy109 Site-Aug.

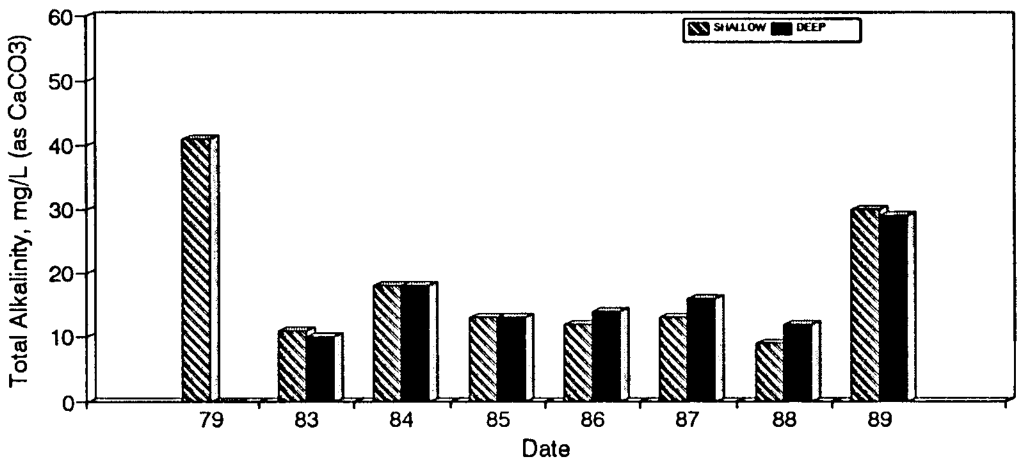

Figure D3. Graph of Total Alkalinity vs. Time for the Hwy109 Site-Dec.

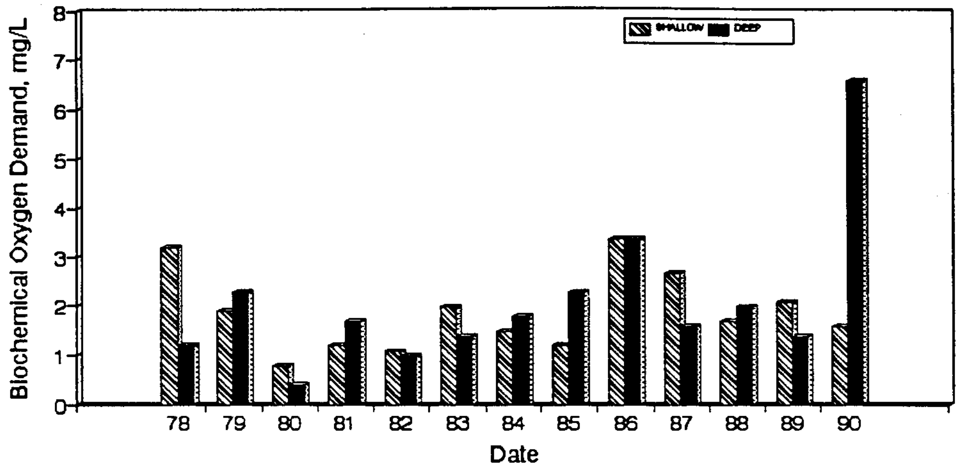

Figure D4. Graph of Biochemical Oxygen Demand vs. Time for the Hwy109 Site-May.

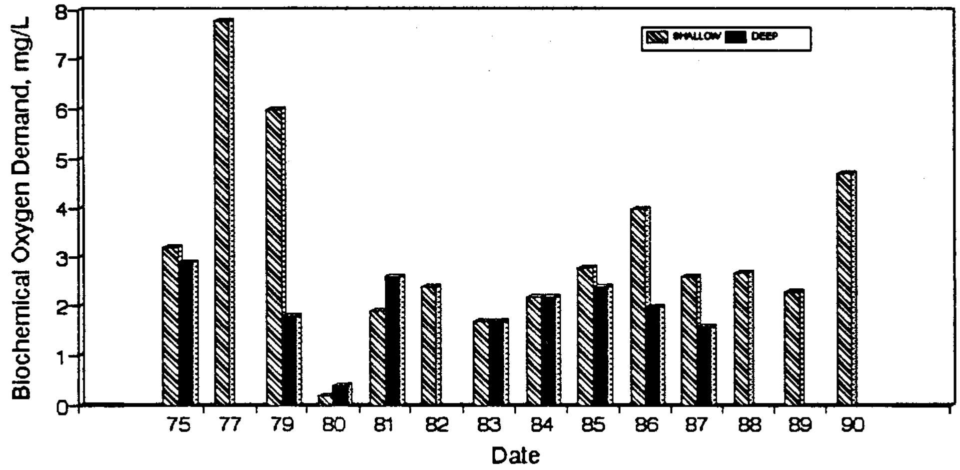

Figure D5. Graph of Biochemical Oxygen Demand vs. Time for the Hwy109 Site-Aug.

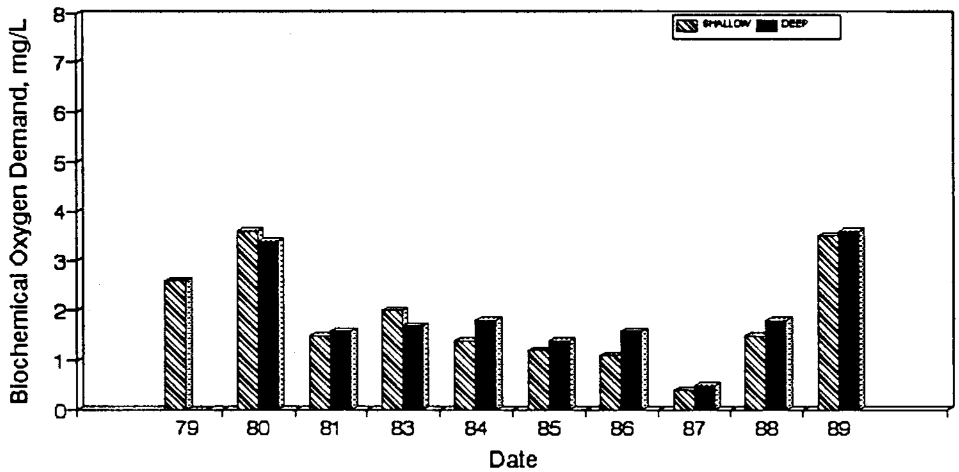

Figure D6. Graph of Biochemical Oxygen Demand vs. Time for the Hwy109 Site-Dec.

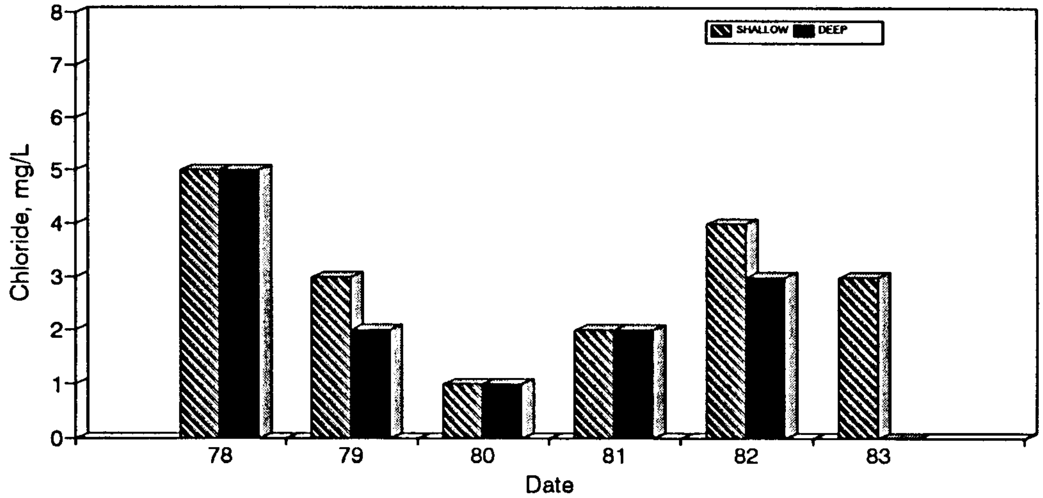

Figure D7. Graph of Chloride vs. Time for the Hwy109 Site-May.

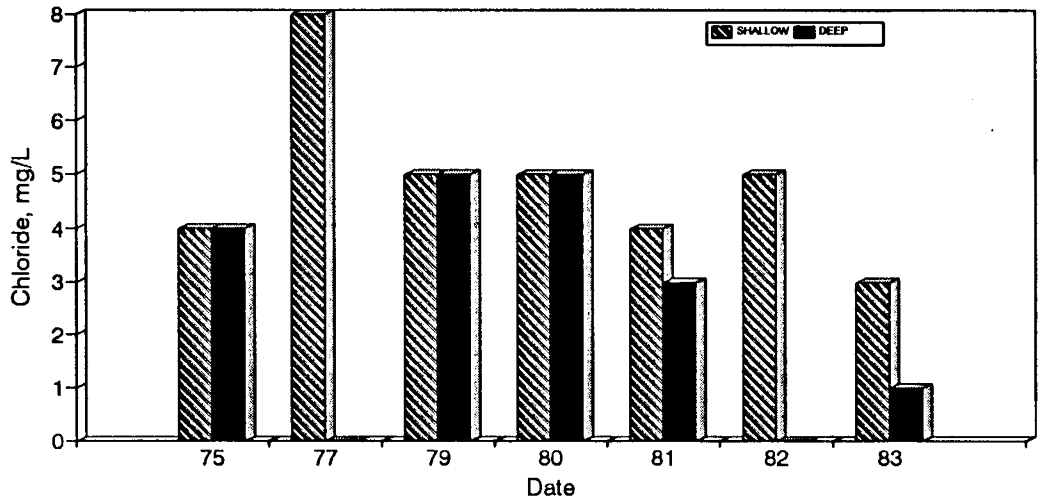

Figure D8. Graph of Chloride vs. Time for the Hwy109 Site-Aug.

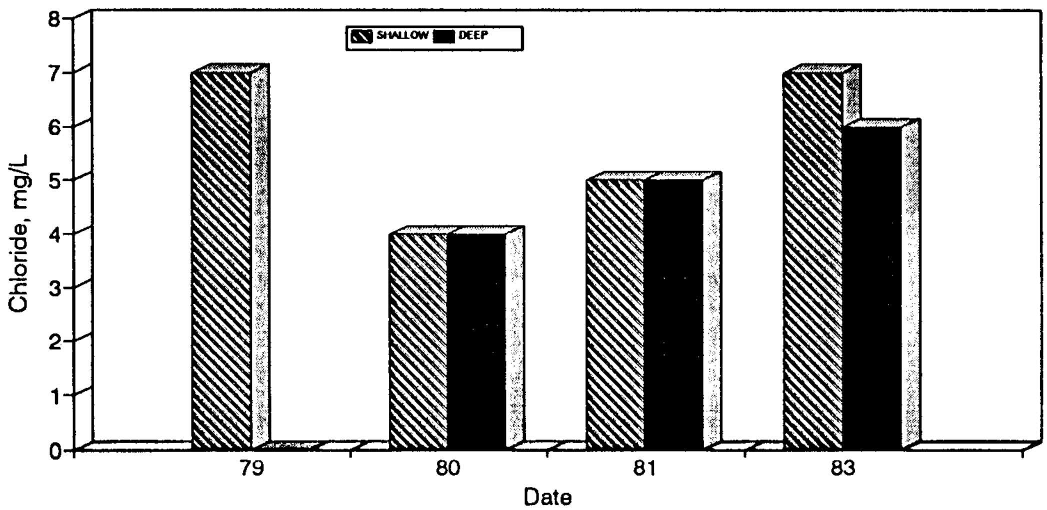

Figure D9. Graph of Chloride vs. Time for the Hwy109 Site-Dec.

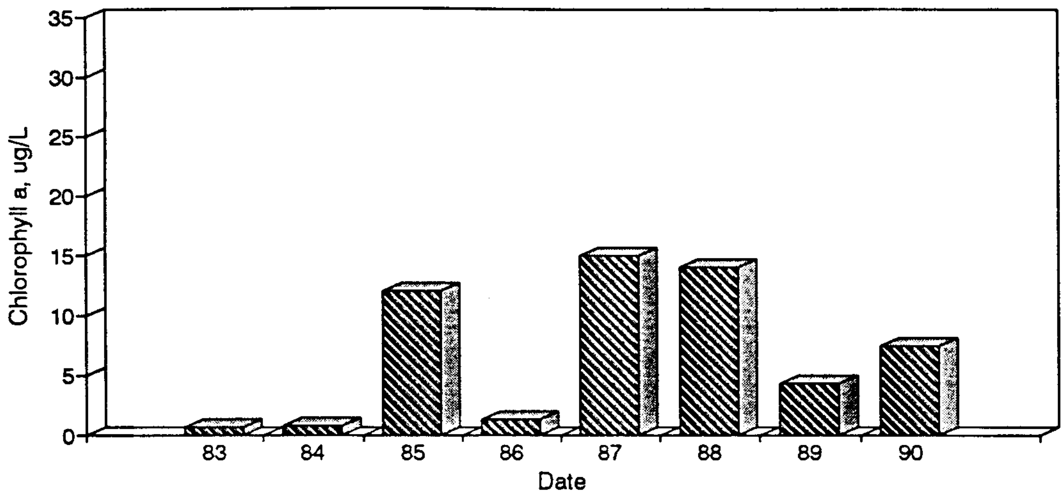

Figure D10. Graph of Chlorophyll a vs. Time for the Hwy109 Site-May.

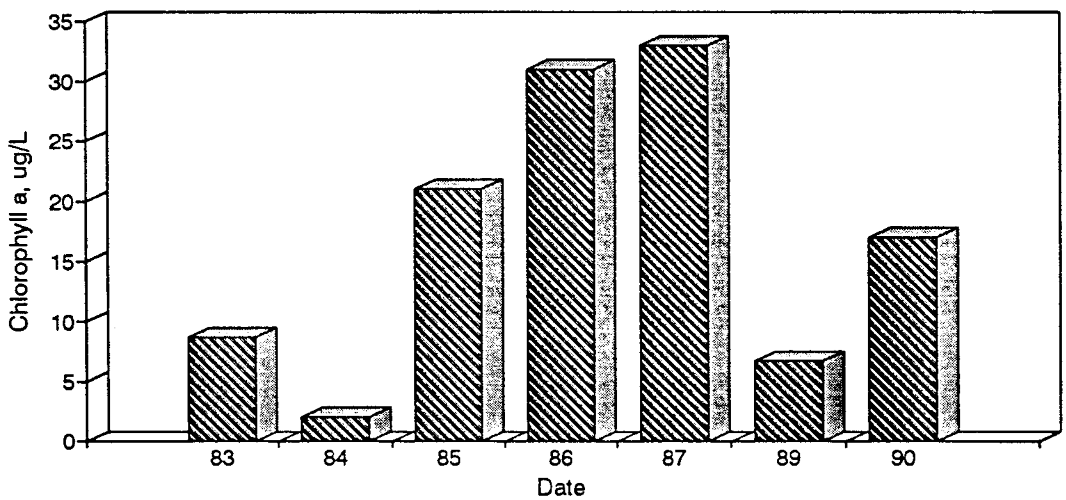

Figure D11. Graph of Chlorophyll a vs. Time for the Hwy109 Site-Aug.

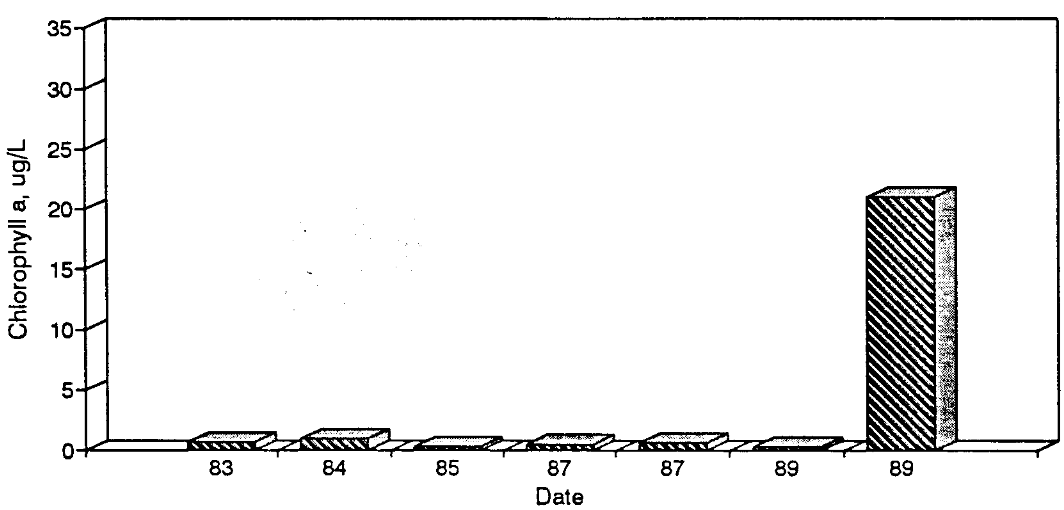

Figure D12. Graph of Chlorophyll a vs. Time for the Hwy109 Site-Dec.

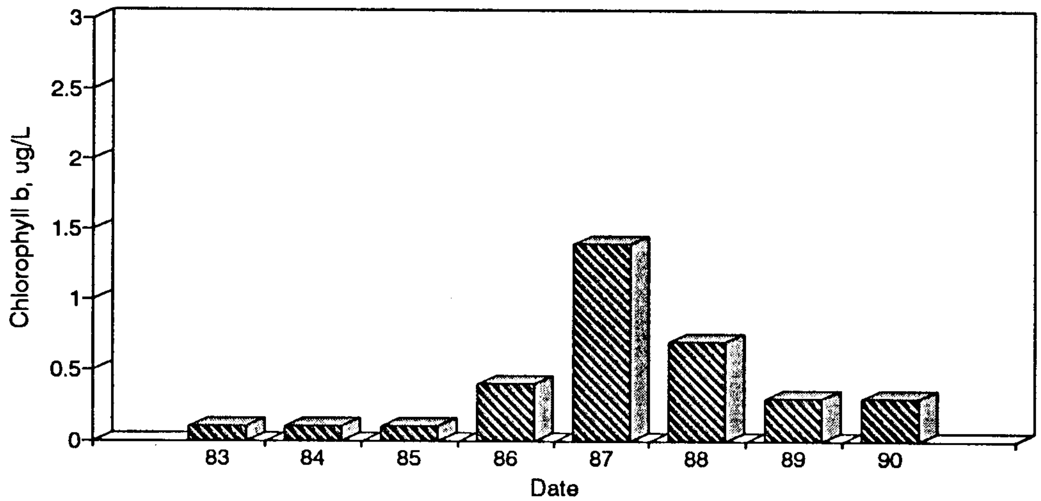

Figure D13. Graph of Chlorophyll b vs. Time for the Hwy109 Site-May.

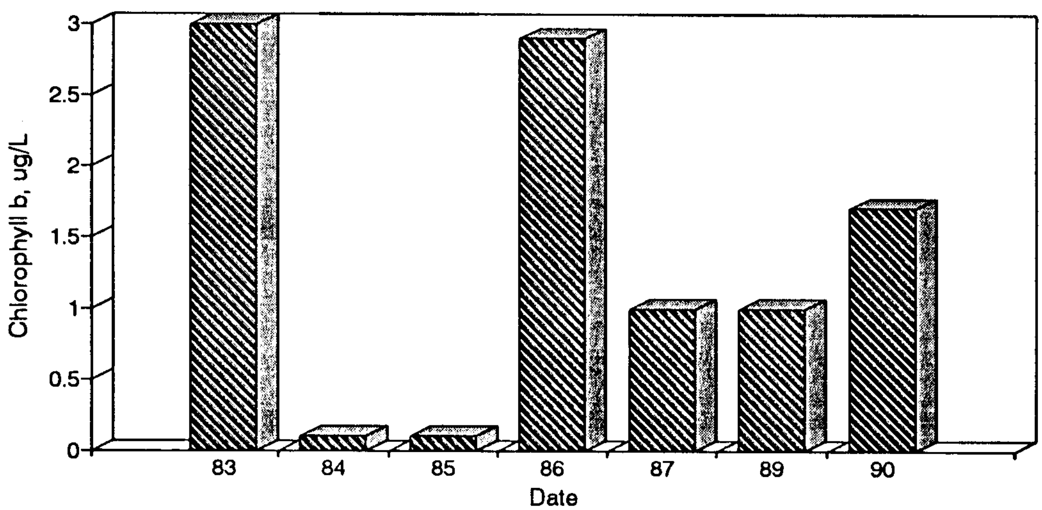

Figure D14. Graph of Chlorophyll b vs. Time for the Hwy109 Site-Aug.

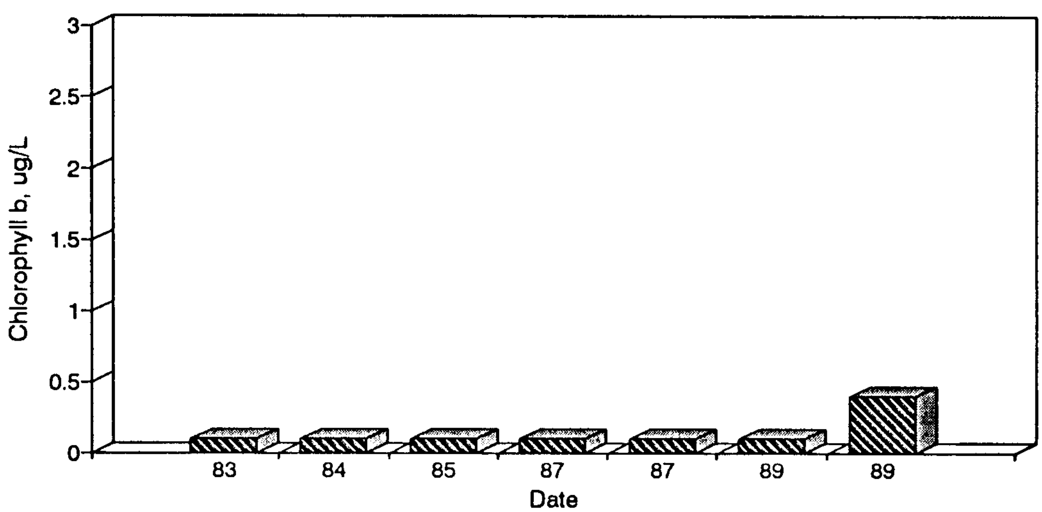

Figure D15. Graph of Chlorophyll b vs. Time for the Hwy109 Site-Dec.

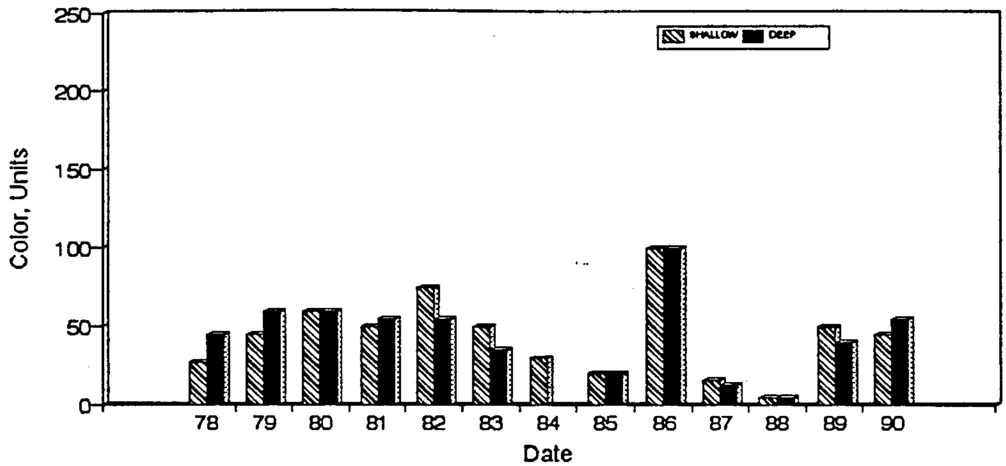

Figure D16. Graph of Color vs. Time for the Hwy109 Site-May.

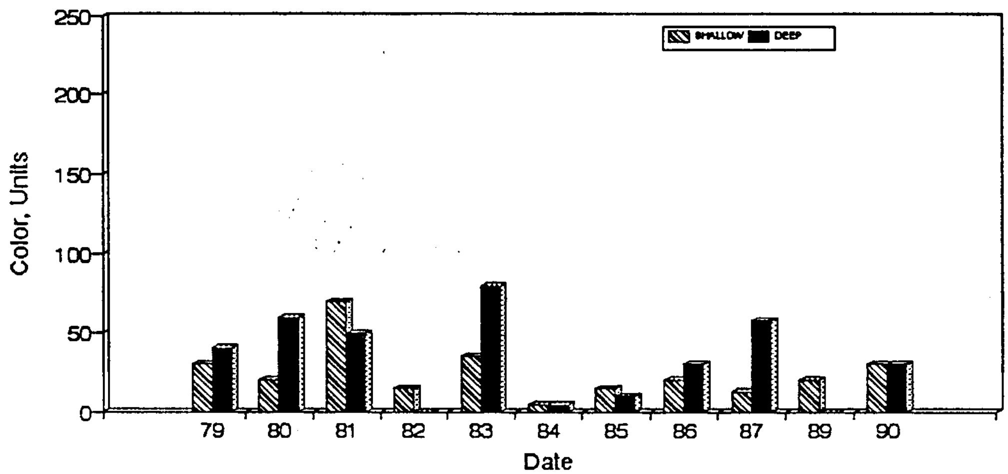

Figure D17. Graph of Color vs. Time for the Hwy109 Site-Aug.

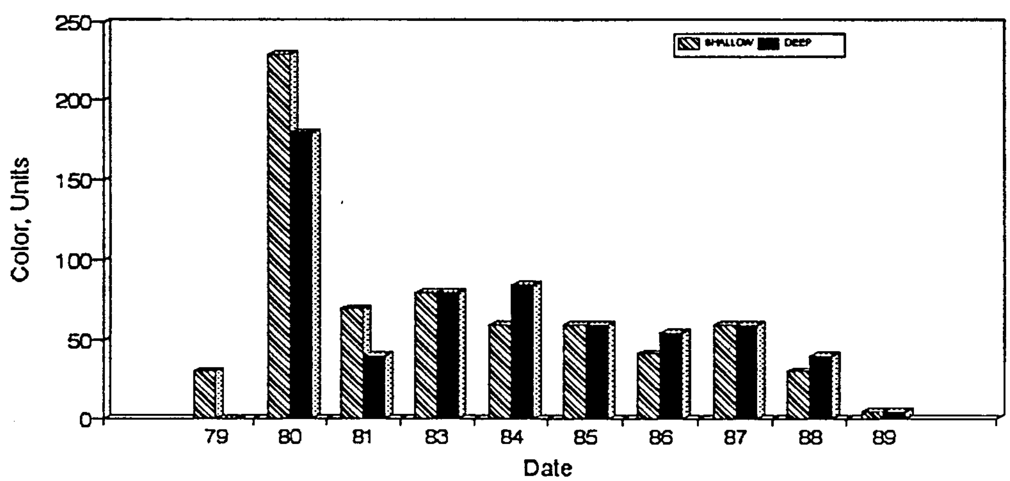

Figure D18. Graph of Color vs. Time for the Hwy109 Site-Dec.

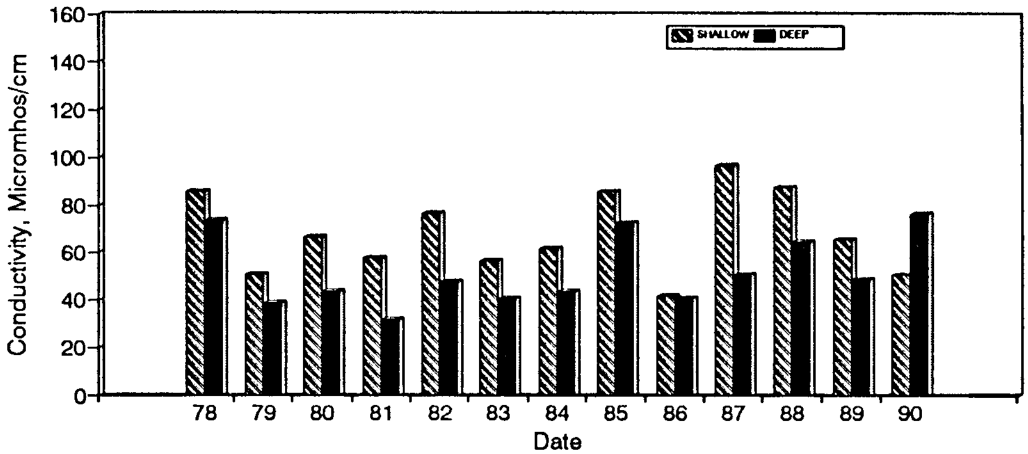

Figure D19. Graph of Conductivity vs. Time for the Hwy109 Site-May.

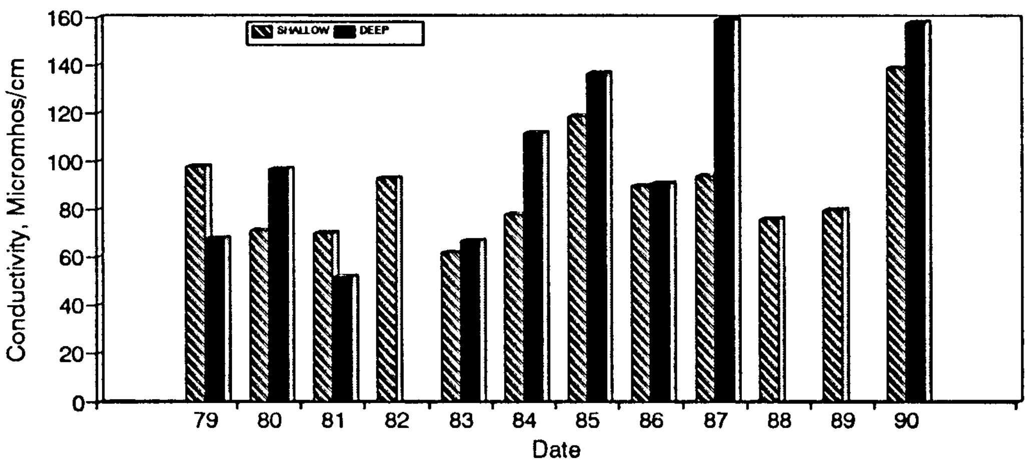

Figure D20. Graph of Conductivity vs. Time for the Hwy109 Site-Aug.

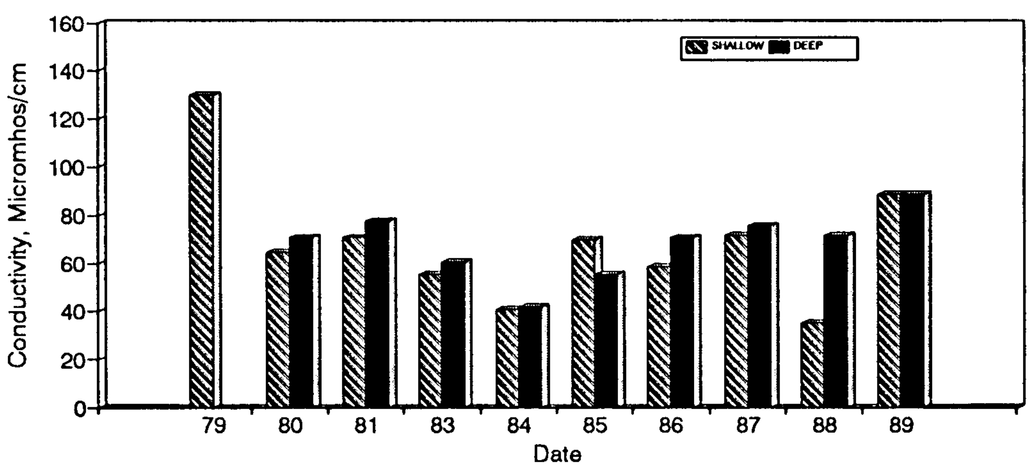

Figure D21. Graph of Conductivity vs. Time for the Hwy109 Site-Dec.

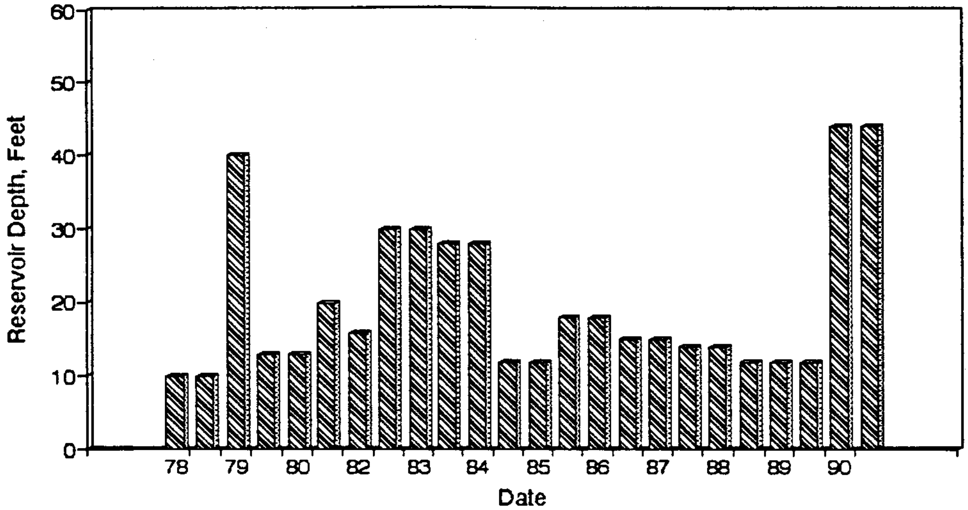

Figure D22. Graph of Reservoir Depth vs. Time for the Hwy109 Site-May.

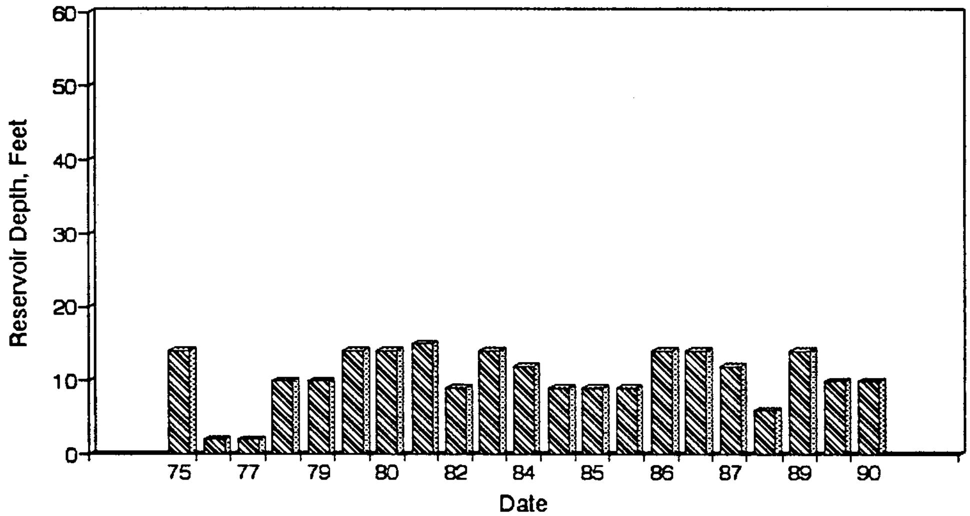

Figure D23. Graph of Reservoir Depth vs. Time for the Hwy109 Site-Aug.

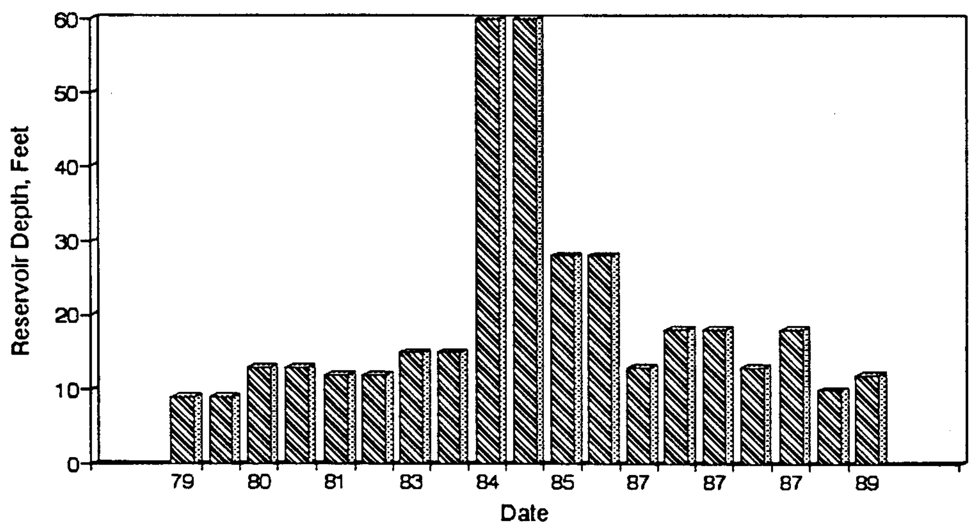

Figure D24. Graph of Reservoir Depth vs. Time for the Hwy109 Site-Dec.

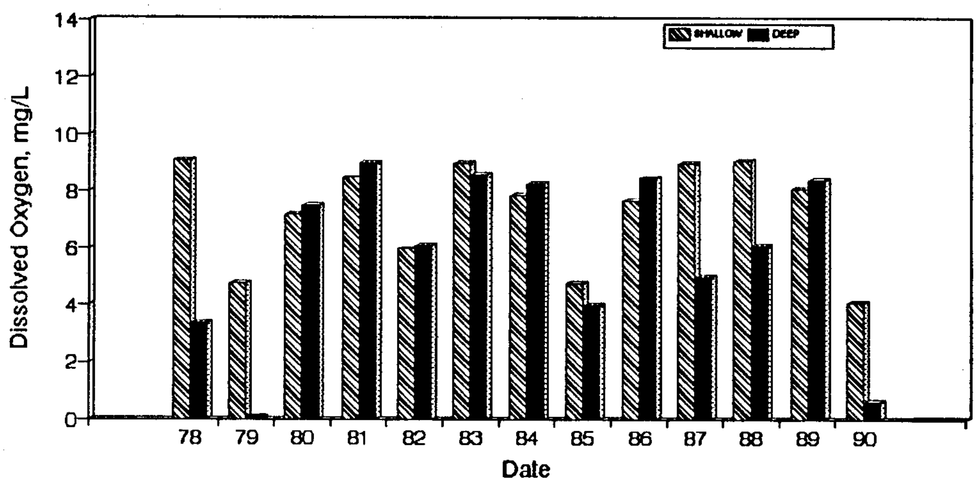

Figure D25. Graph of Dissolved Oxygen vs. Time for the Hwy109 Site-May.

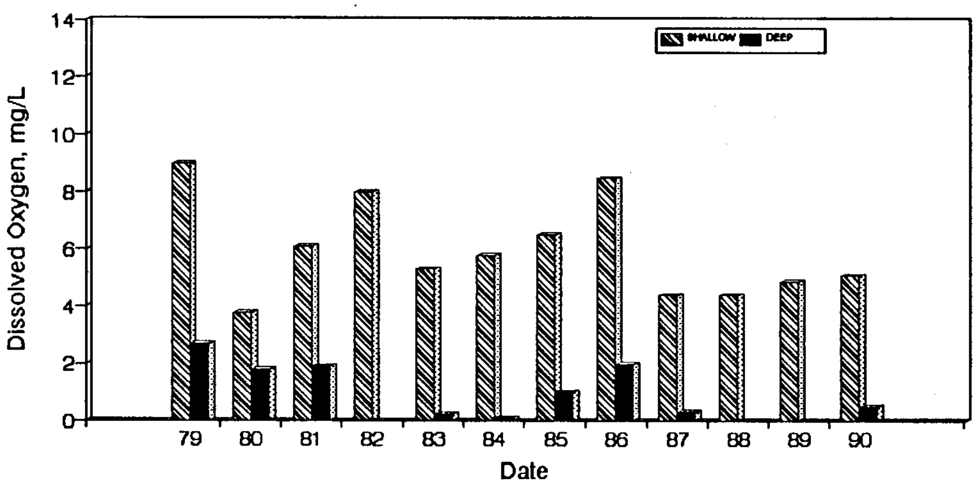

Figure D26. Graph of Dissolved Oxygen vs. Time for the Hwy109 Site-Aug.

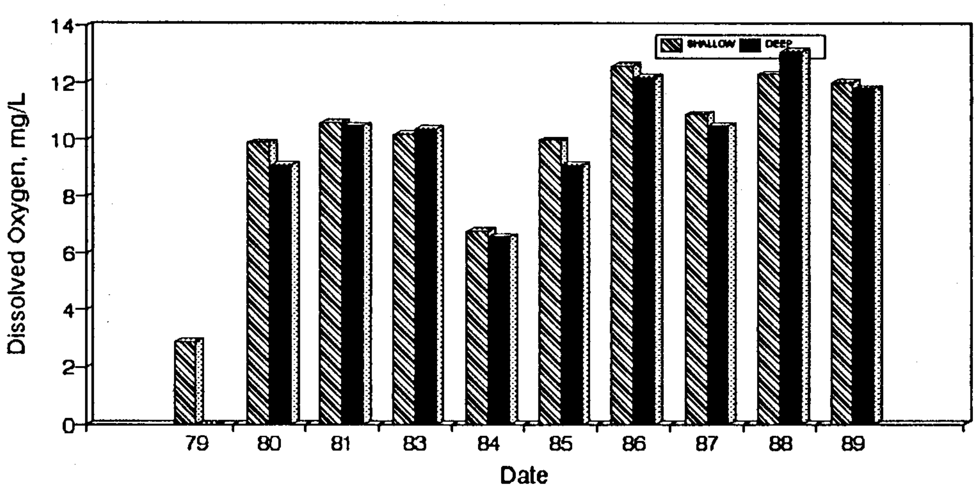

Figure D27. Graph of Dissolved Oxygen vs. Time for the Hwy109 Site-Dec.

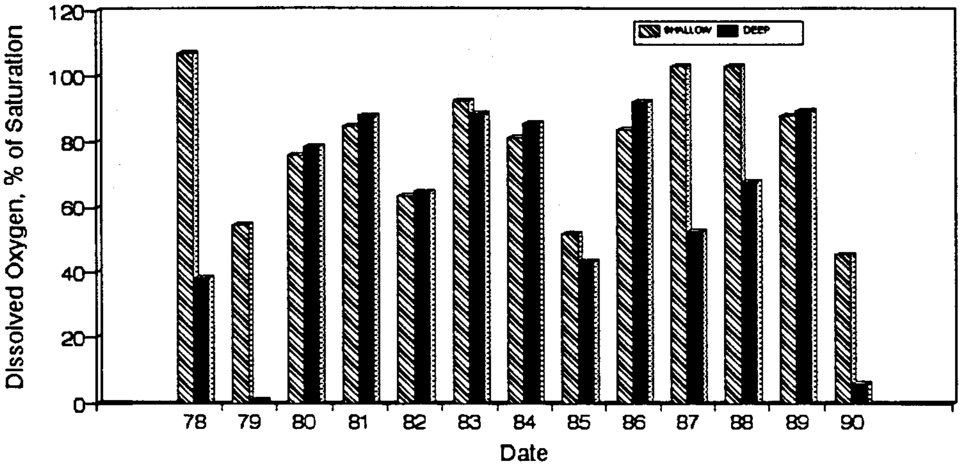

Figure D28. Graph of Dissolved Oxygen vs. Time for the Hwy109 Site-May.

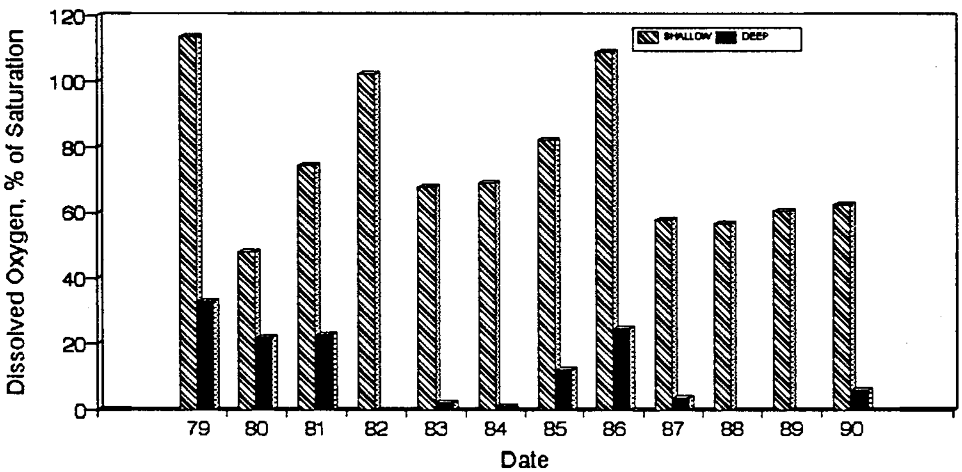

Figure D29. Graph of Dissolved Oxygen vs. Time for the Hwy109 Site-Aug.

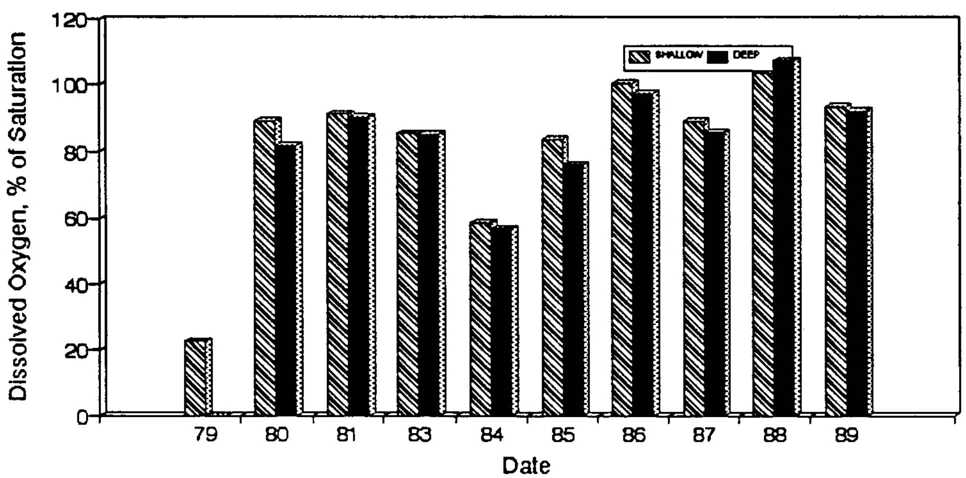

Figure D30. Graph of Dissolved Oxygen vs. Time for the Hwy109 Site-Dec.

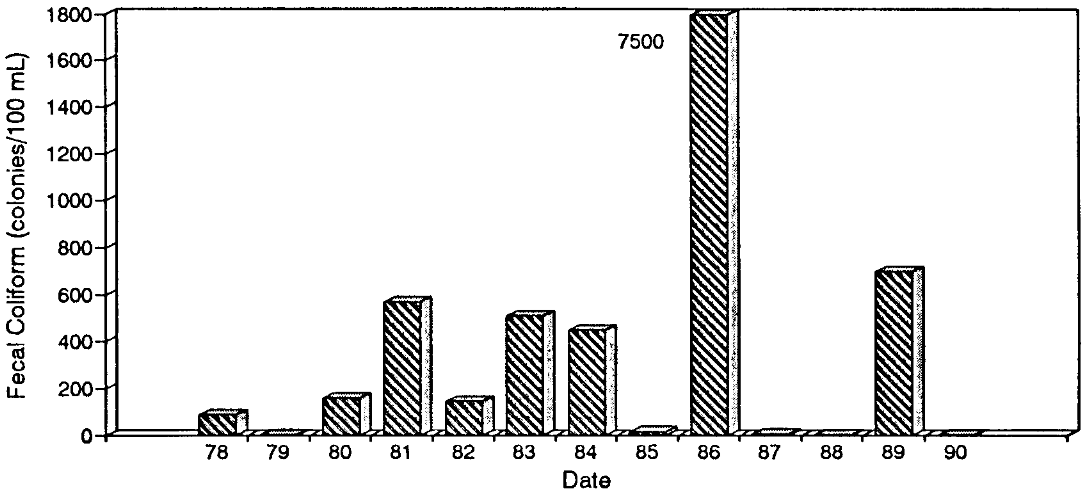

Figure D31. Graph of Fecal Coliform vs. Time for the Hwy109 Site-May.

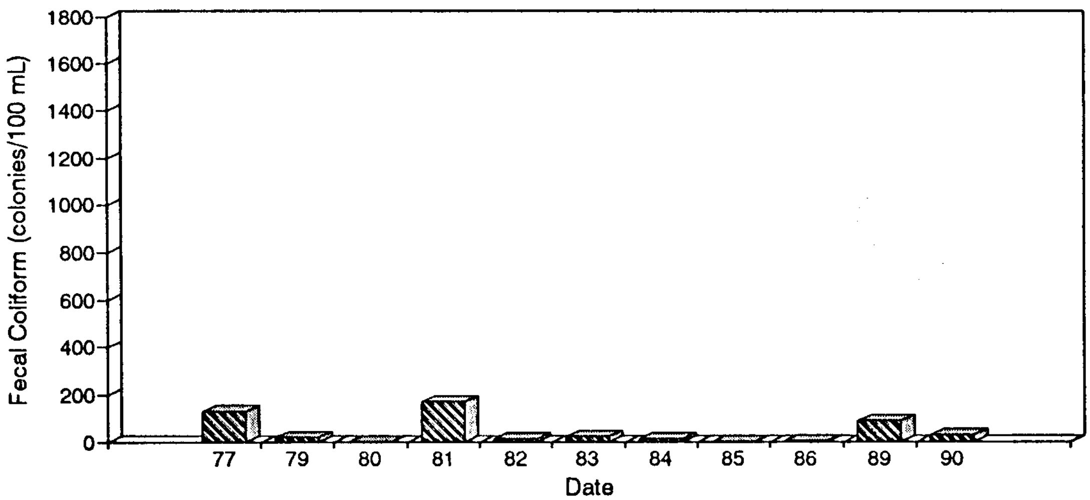

Figure D32. Graph of Fecal Coliform vs. Time for the Hwy109 Site-Aug.

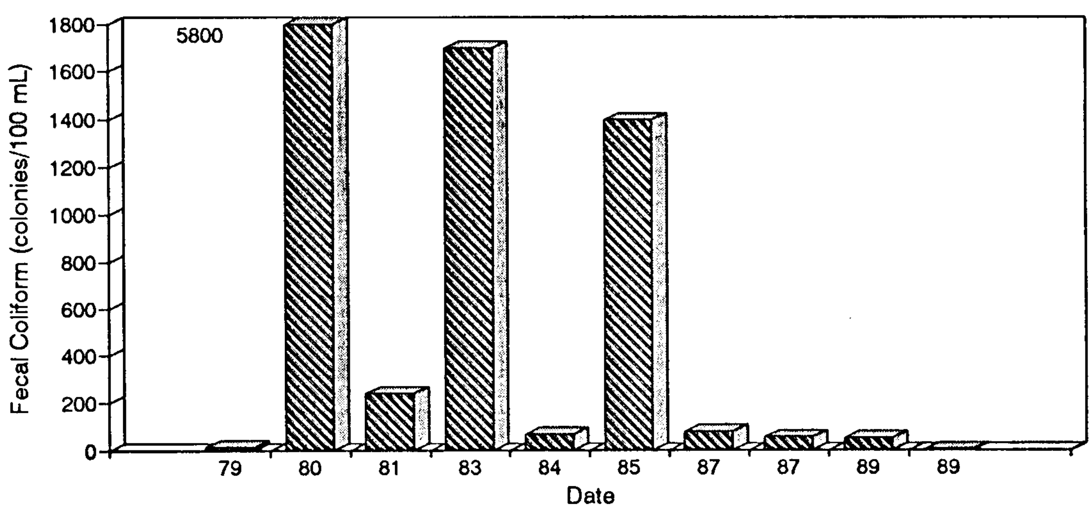

Figure D33. Graph of Fecal Coliform vs. Time for the Hwy109 Site-Dec.

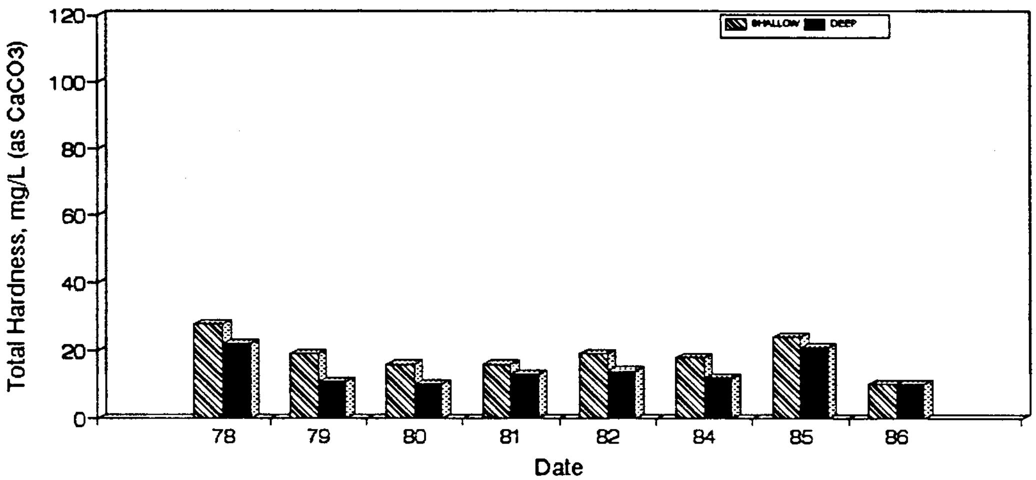

Figure D34. Graph of Total Hardness vs. Time for the Hwy109 Site-May.

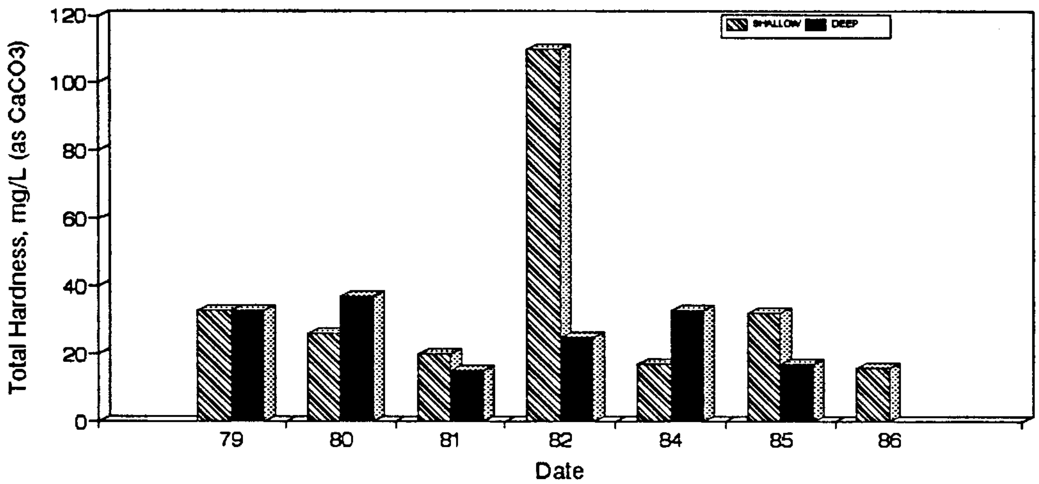

Figure D35. Graph of Total Hardness vs. Time for the Hwy109 Site-Aug.

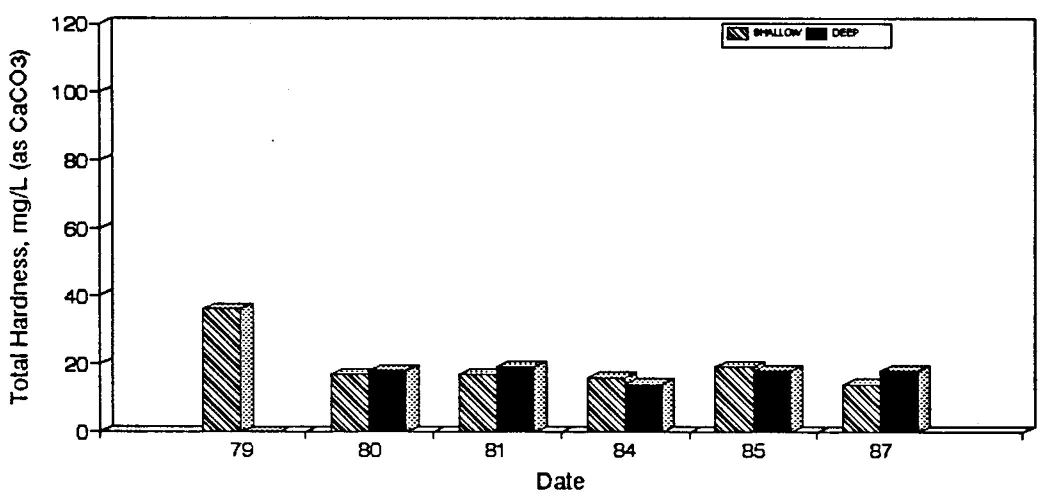

Figure D36. Graph of Total Hardness vs. Time for the Hwy109 Site-Dec.

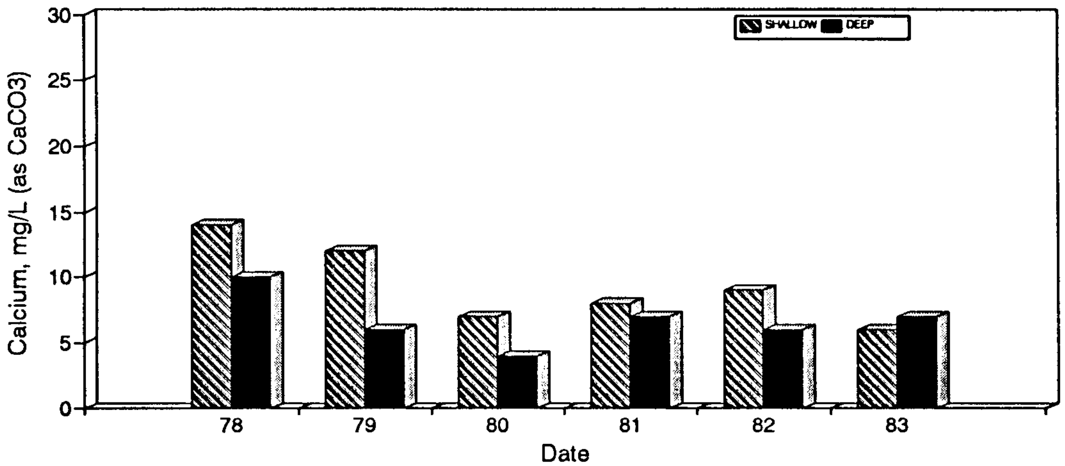

Figure D37. Graph of Calcium vs. Time for the Hwy109 Site-May.

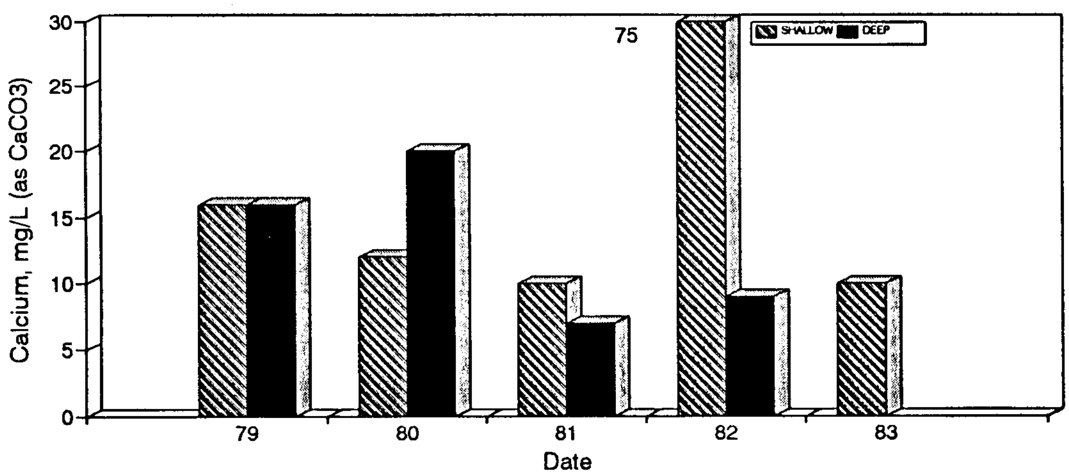

Figure D38. Graph of Calcium vs. Time for the Hwy109 Site-Aug.

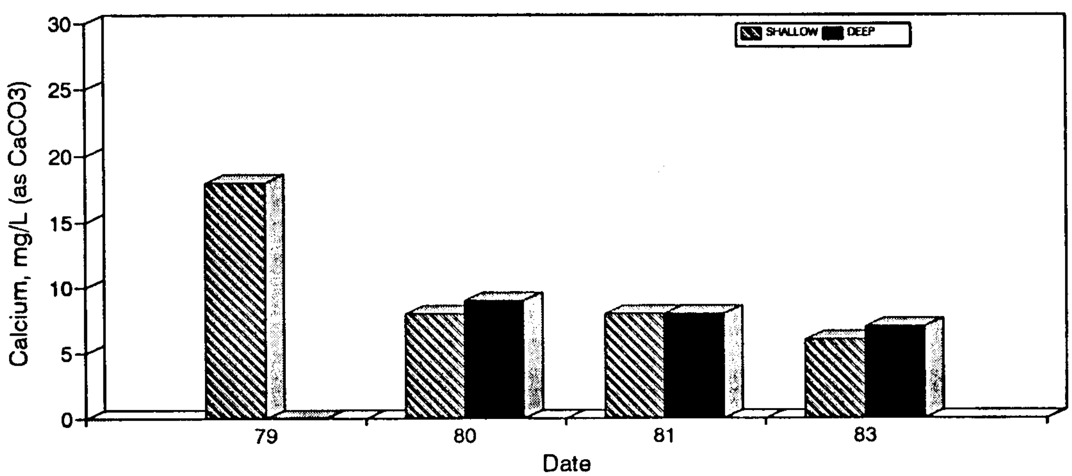

Figure D39. Graph of Calcium vs. Time for the Hwy109 Site-Dec.

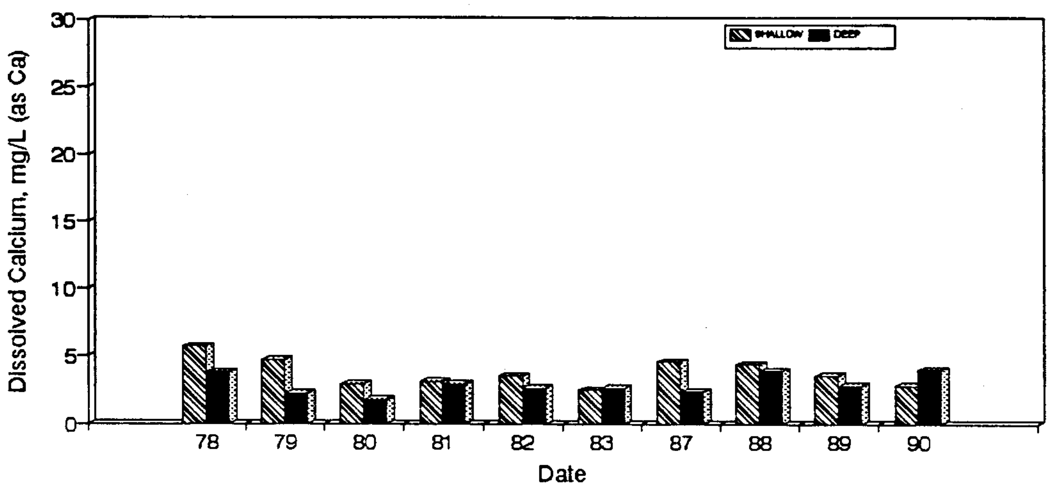

Figure D40. Graph of Dissolved Calcium vs. Time for the Hwy109 Site-May.

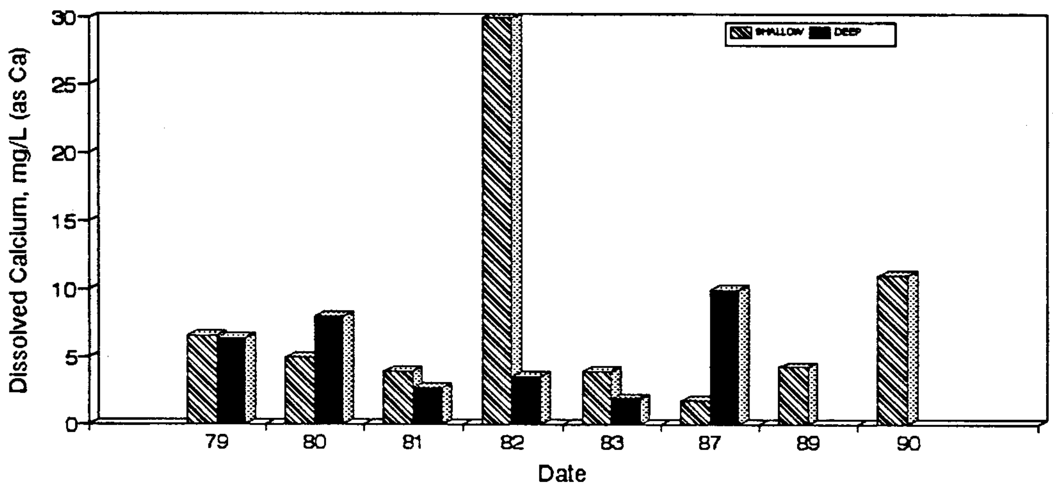

Figure D41. Graph of Dissolved Calcium vs. Time for the Hwy109 Site-Aug.

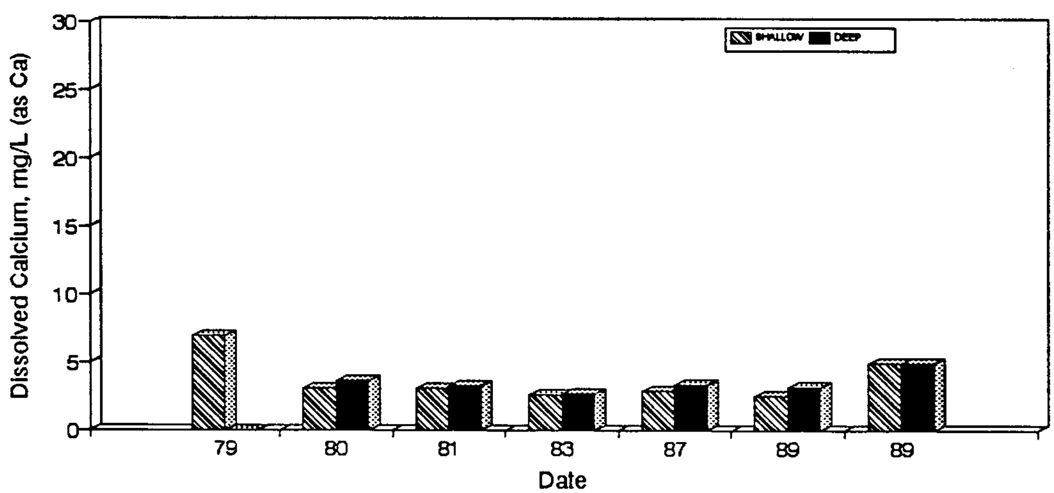

Figure D42. Graph of Dissolved Calcium vs. Time for the Hwy109 Site-Dec.

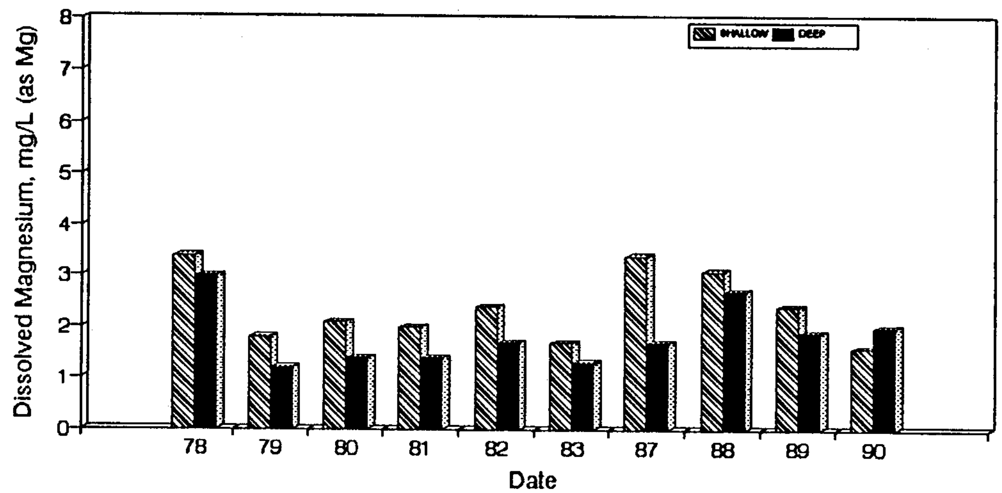

Figure D43. Graph of Dissolved Magnesium vs. Time for the Hwy109 Site-May.

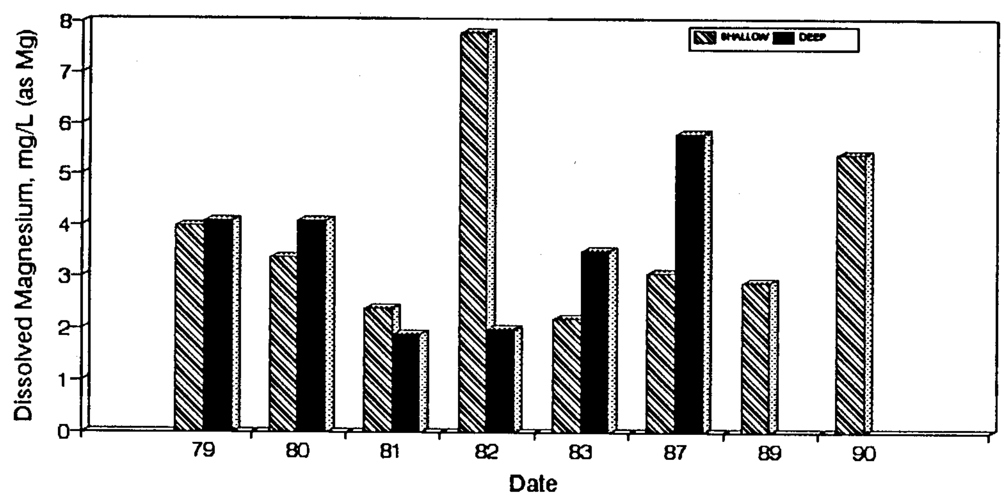

Figure D44. Graph of Dissolved Magnesium vs. Time for the Hwy109 Site-Aug.

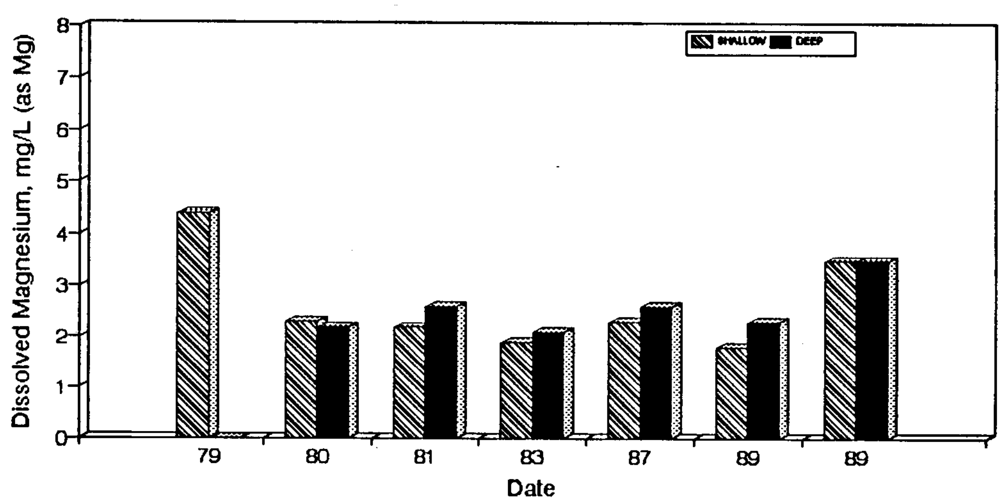

Figure D45. Graph of Dissolved Magnesium vs. Time for the Hwy109 Site-Dec.

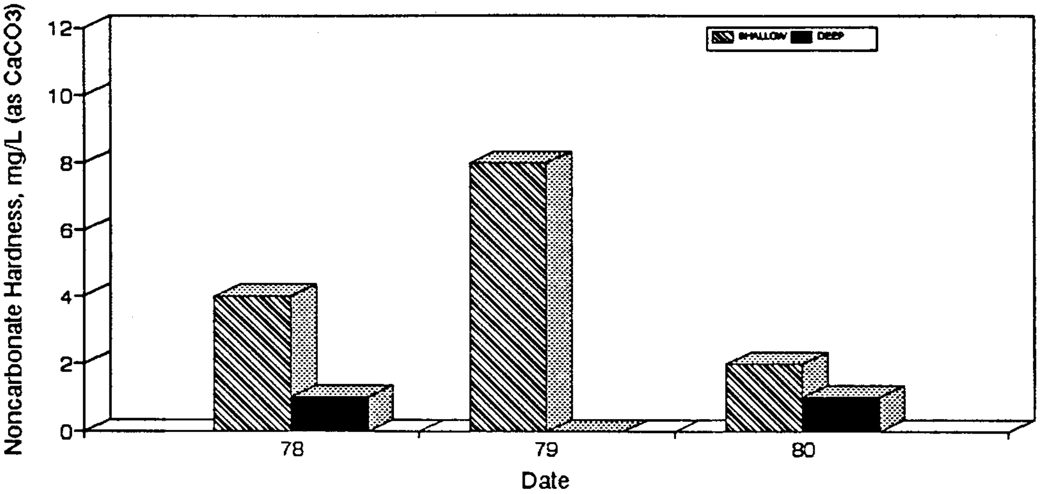

Figure D46. Graph of Noncarbonate Hardness vs. Time for the Hwy109 Site-May.

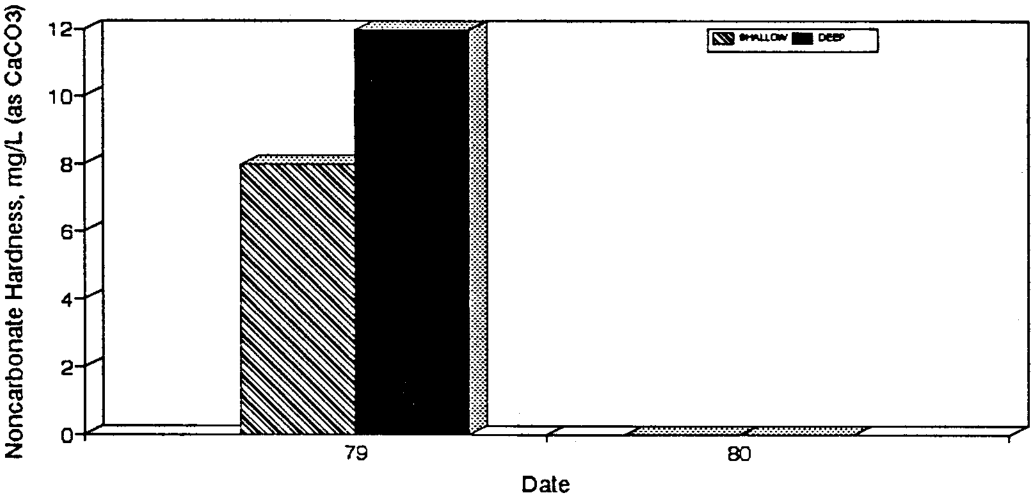

Figure D47. Graph of Noncarbonate Hardness vs. Time for the Hwy109 Site-Aug.

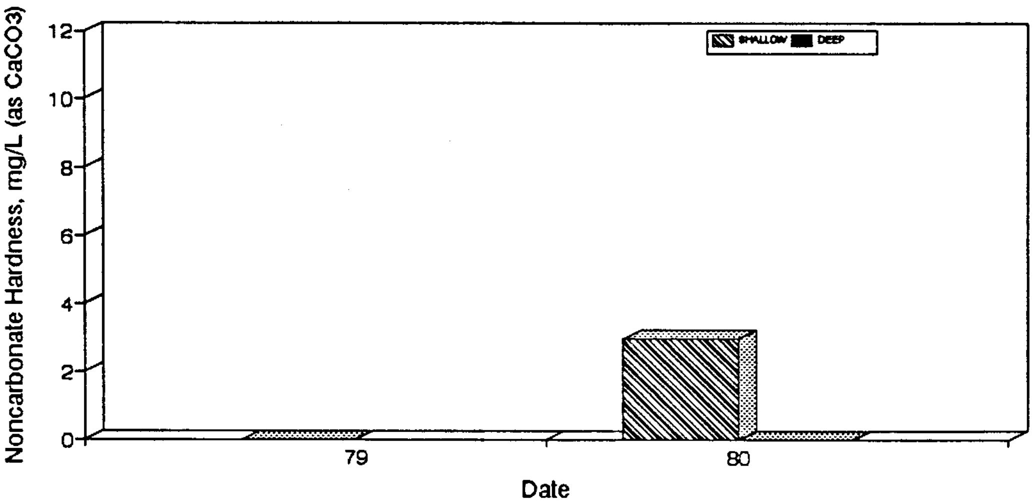

Figure D48. Graph of Noncarbonate Hardness vs. Time for the Hwy109 Site-Dec.

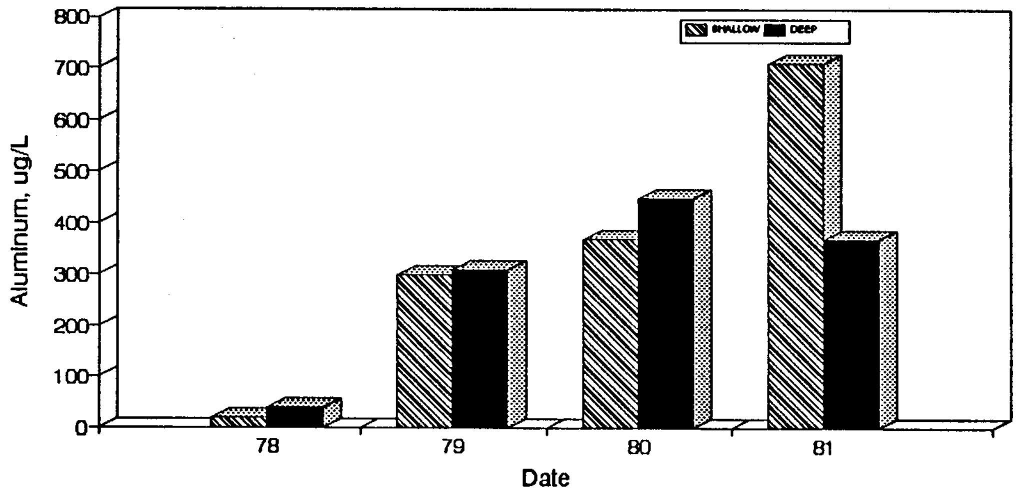

Figure D49. Graph of Aluminum vs. Time for the Hwy109 Site-May.

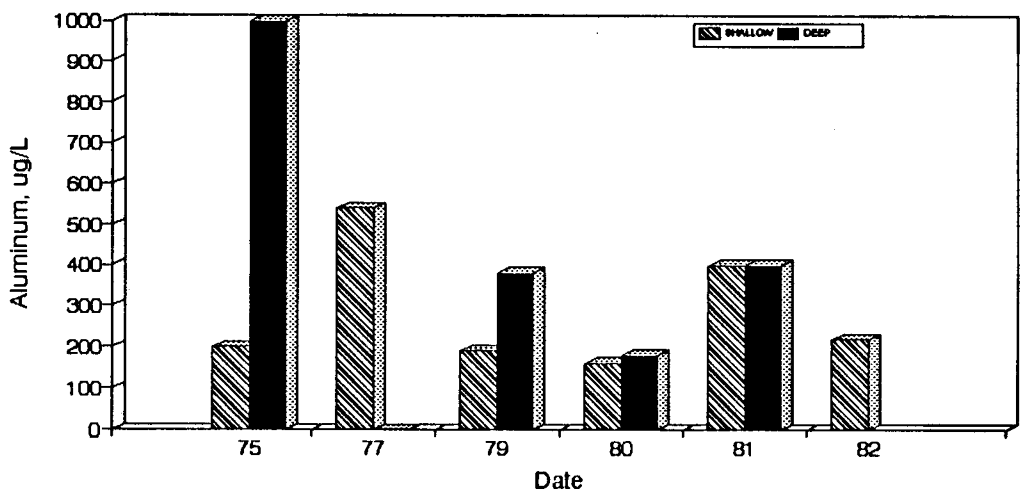

Figure D50. Graph of Aluminum vs. Time for the Hwy109 Site-Aug.

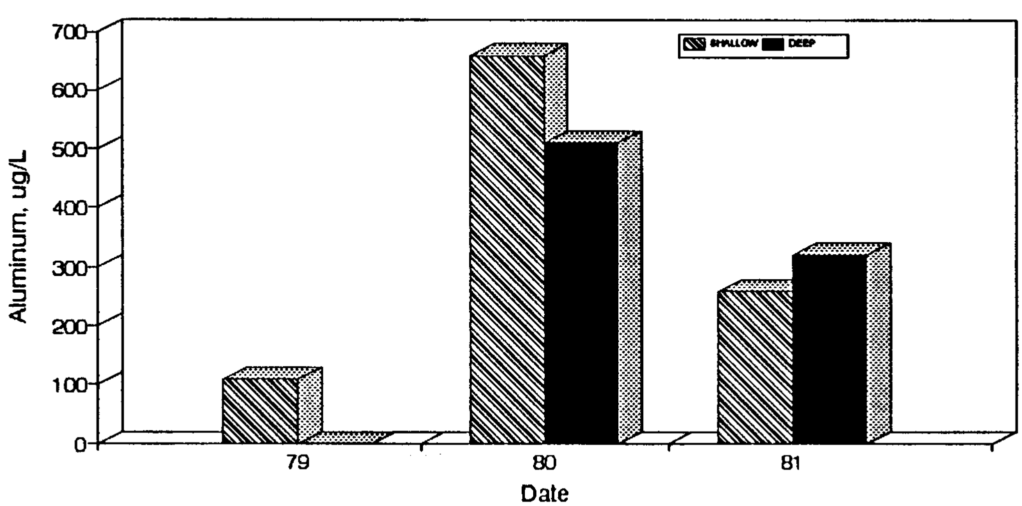

Figure D51. Graph of Aluminum vs. Time for the Hwy109 Site-Dec.

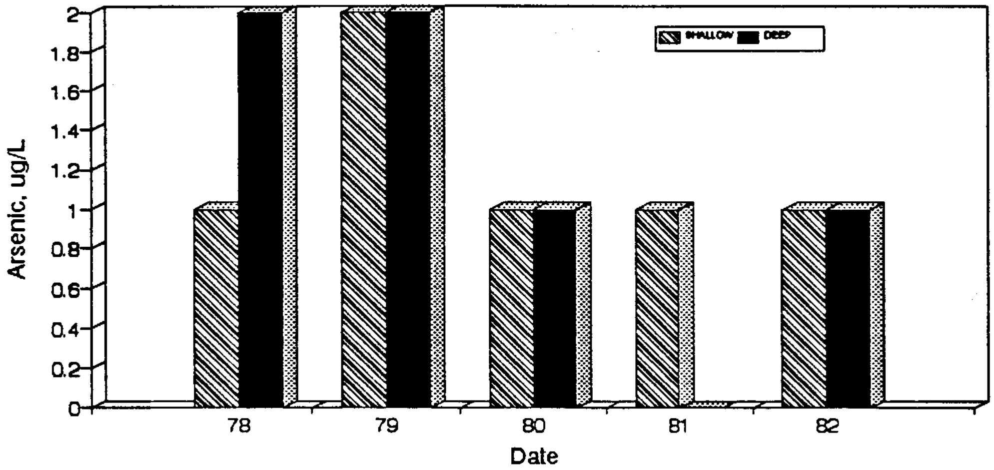

Figure D52. Graph of Arsenic vs. Time for the Hwy109 Site-May.

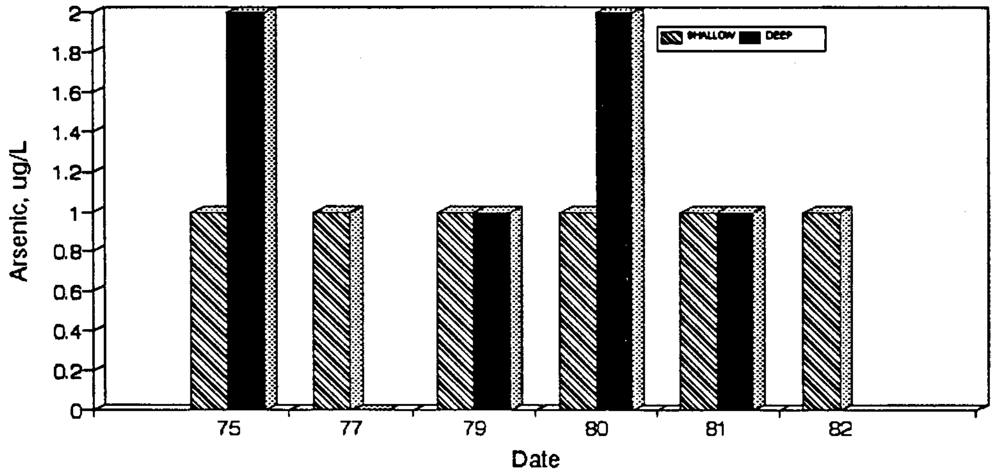

Figure D53. Graph of Arsenic vs. Time for the Hwy109 Site-Aug.

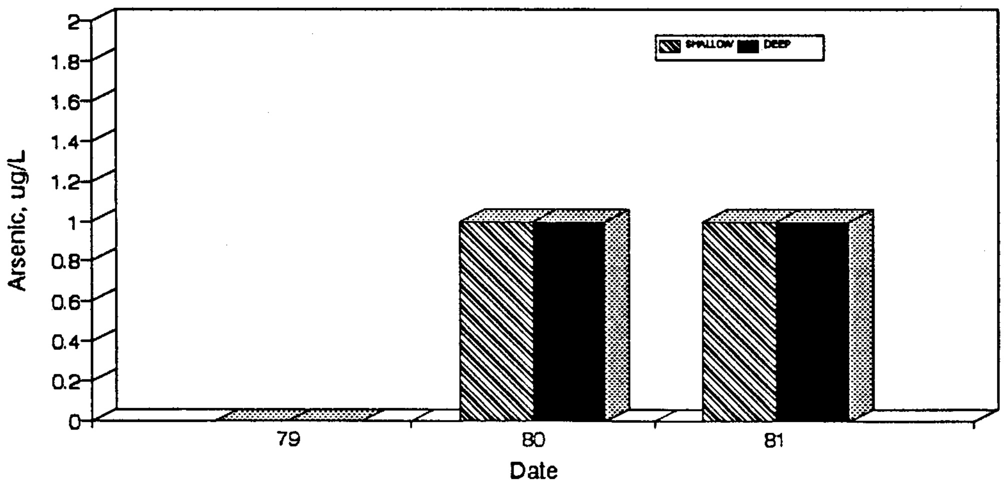

Figure D54. Graph of Arsenic vs. Time for the Hwy109 Site-Dec.

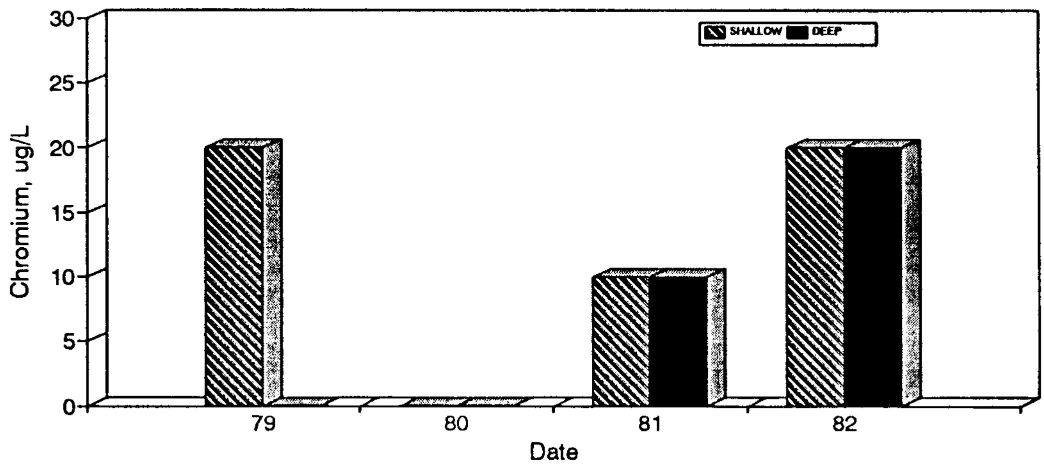

Figure D55. Graph of Chromium vs. Time for the Hwy109 Site-May.

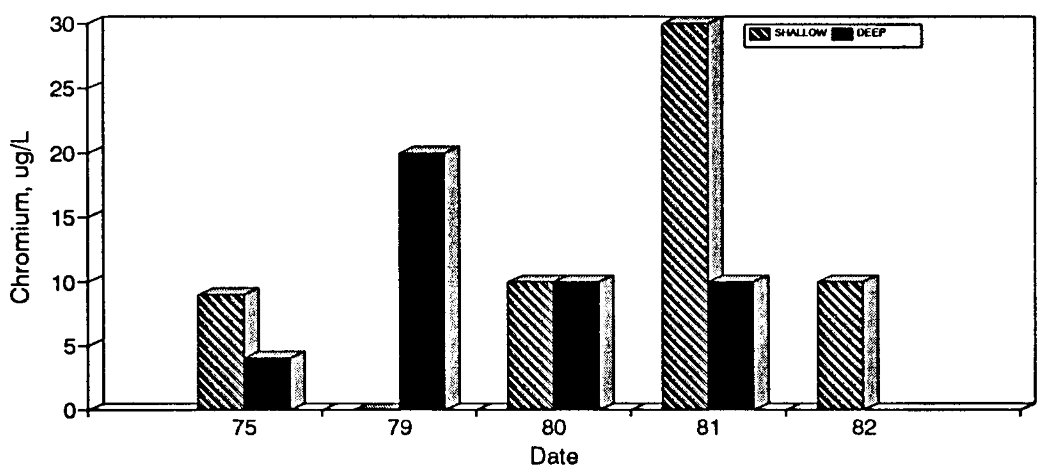

Figure D56. Graph of Chromium vs. Time for the Hwy109 Site-Aug.

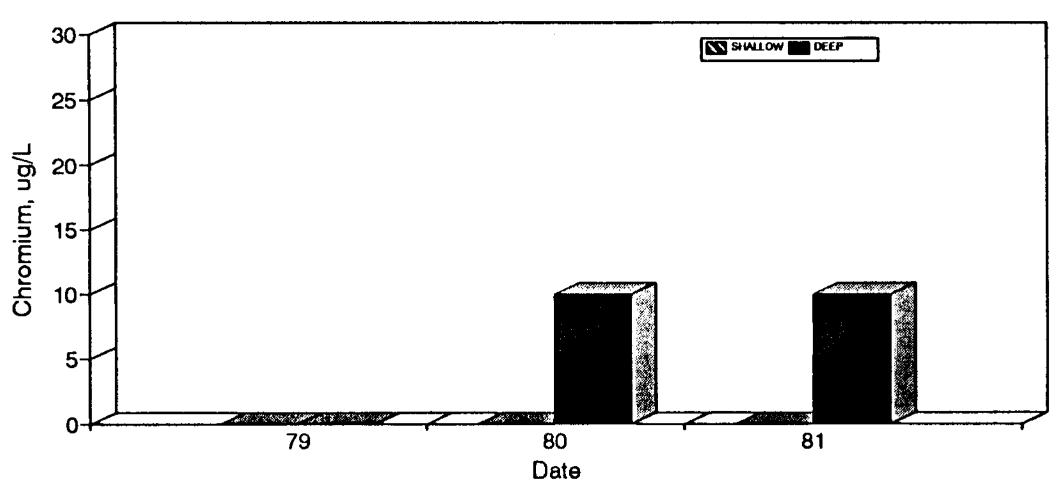

Figure D57. Graph of Chromium vs. Time for the Hwy109 Site-Dec.

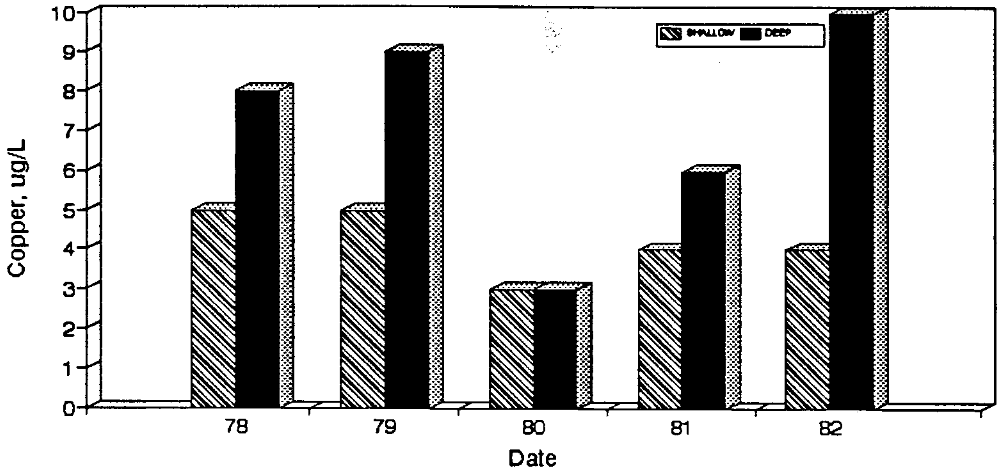

Figure D58. Graph of Copper vs. Time for the Hwy109 Site-May.

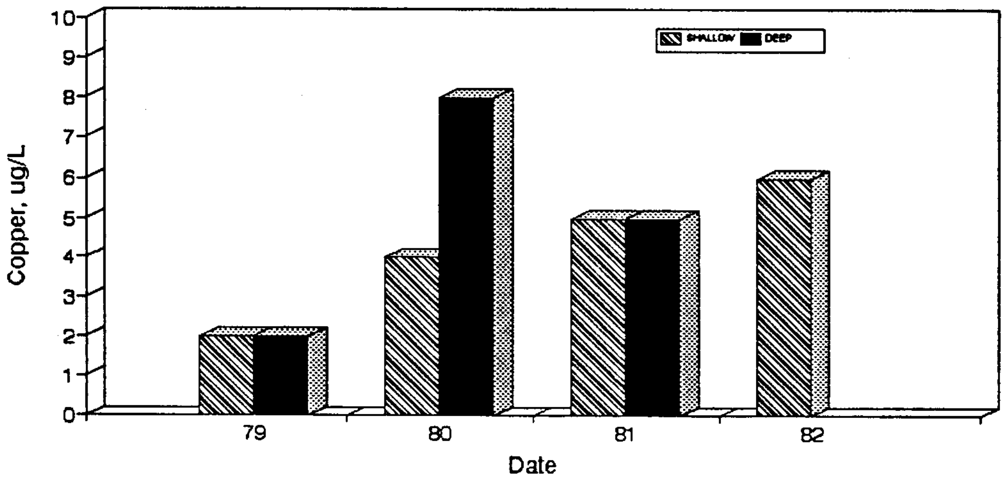

Figure D59. Graph of Copper vs. Time for the Hwy109 Site-Aug.

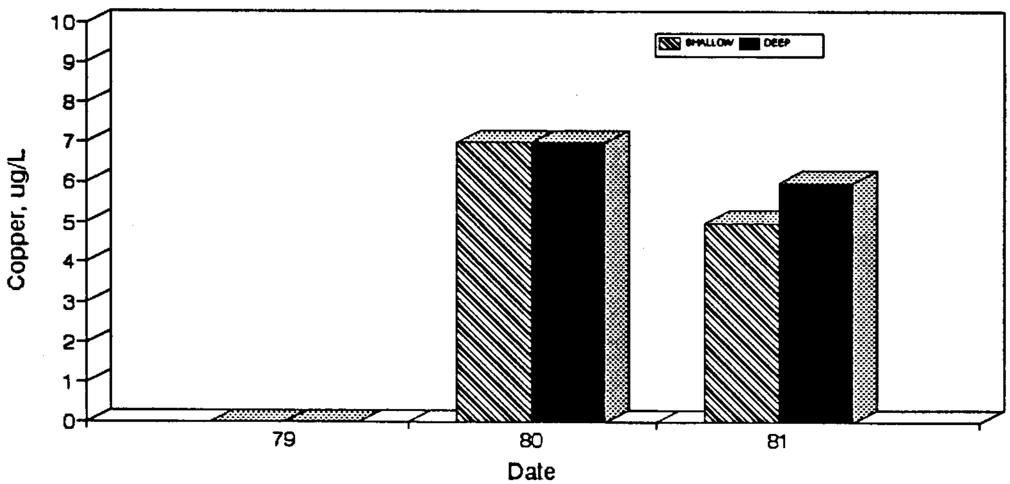

Figure D60. Graph of Copper vs. Time for the Hwy109 Site-Dec.

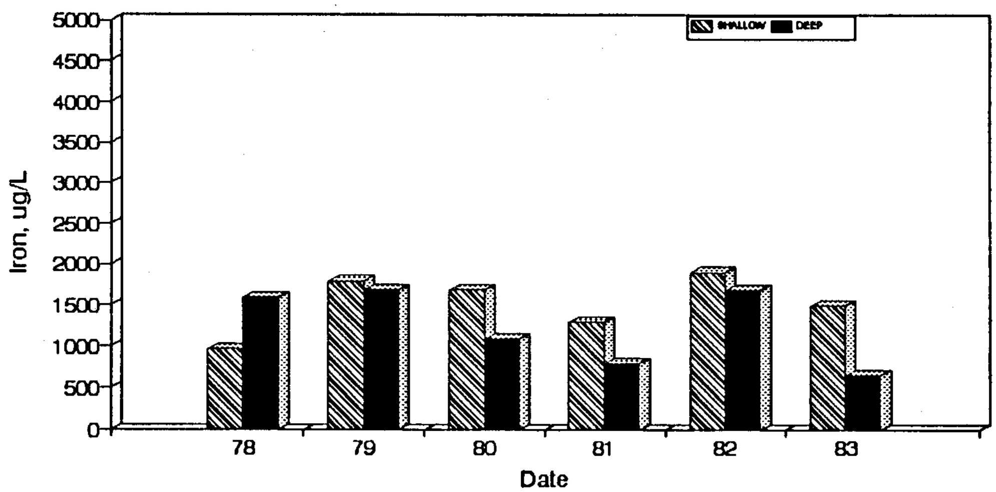

Figure D61. Graph of Iron vs. Time for the Hwy109 Site-May.

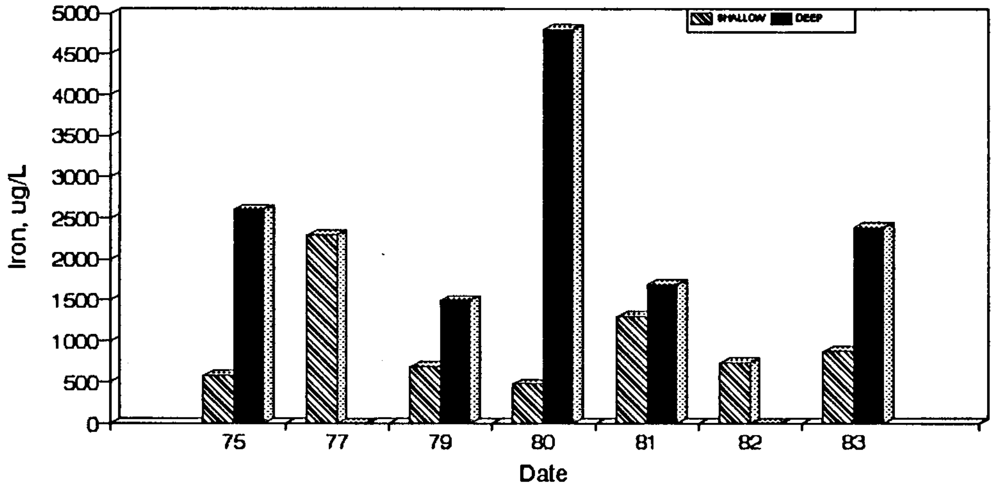

Figure D62. Graph of Iron vs. Time for the Hwy109 Site-Aug.

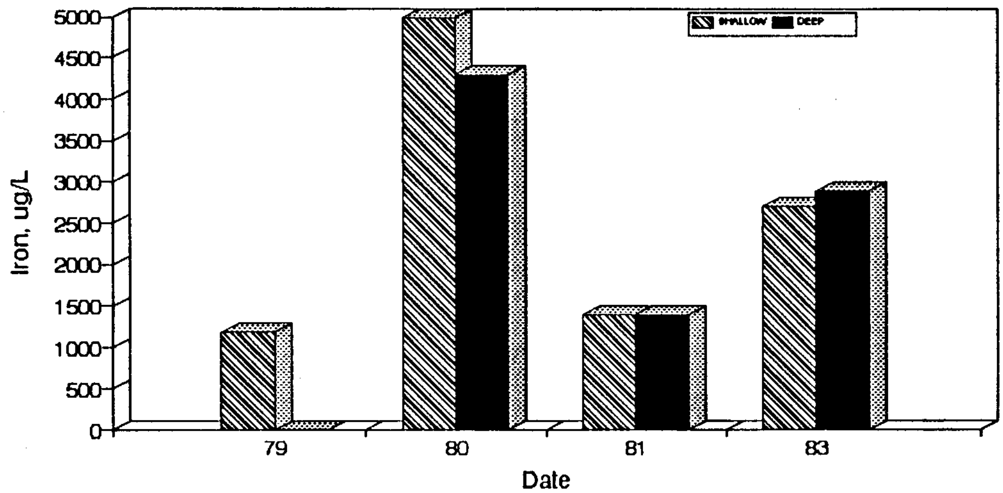

Figure D63. Graph of Iron vs. Time for the Hwy109 Site-Dec.

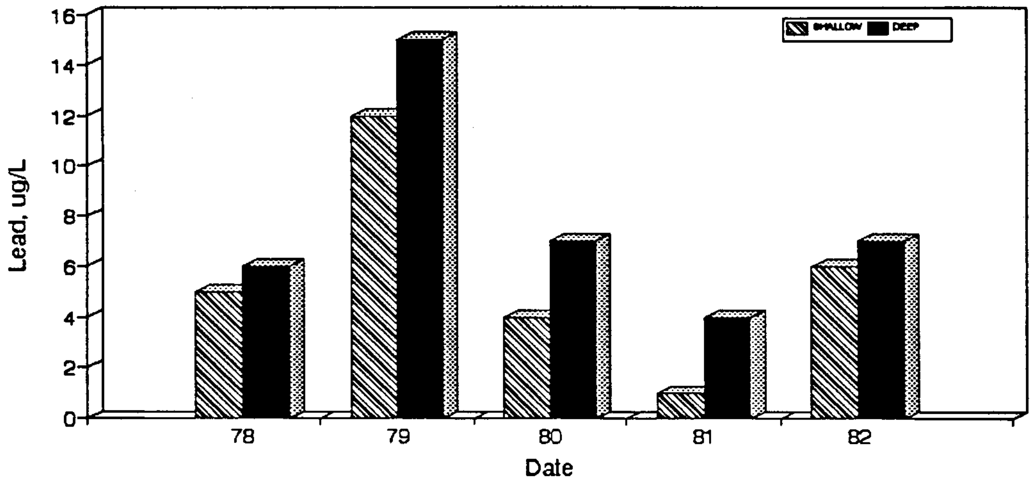

Figure D64. Graph of Lead vs. Time for the Hwy109 Site-May.

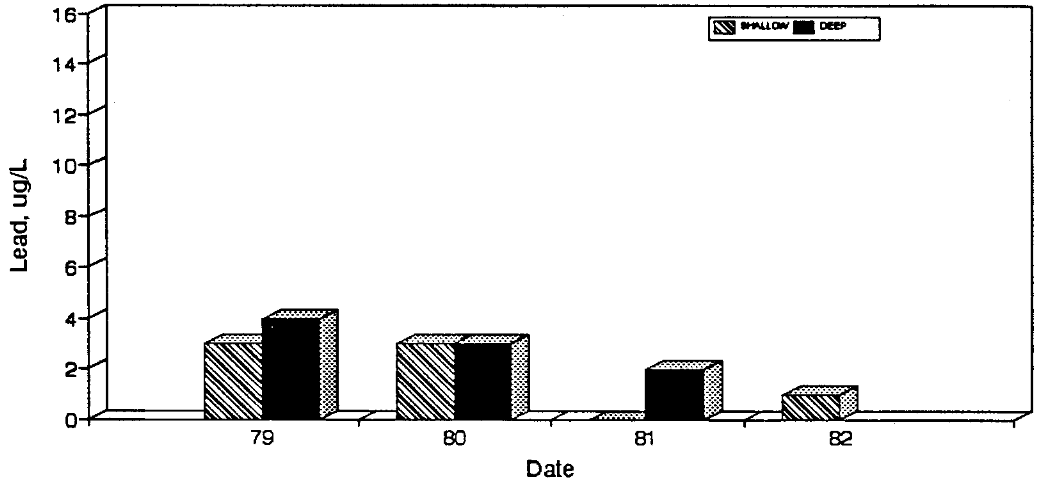

Figure D65. Graph of Lead vs. Time for the Hwy109 Site-Aug.

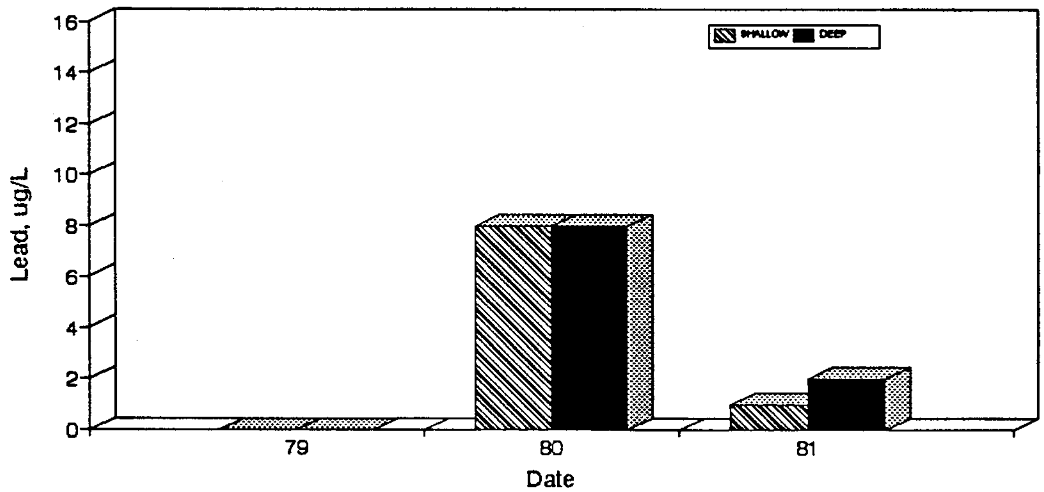

Figure D66. Graph of Lead vs. Time for the Hwy109 Site-Dec.

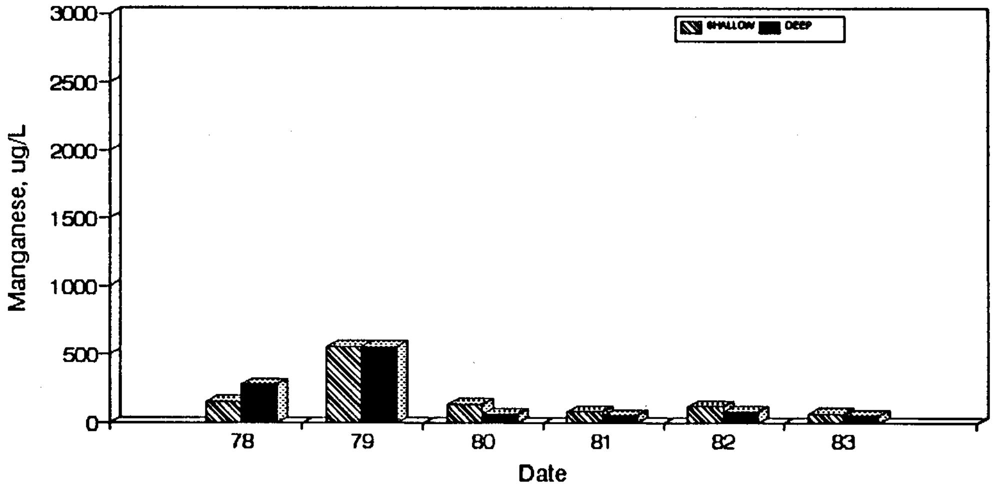

Figure D67. Graph of Manganese vs. Time for the Hwy109 Site-May.

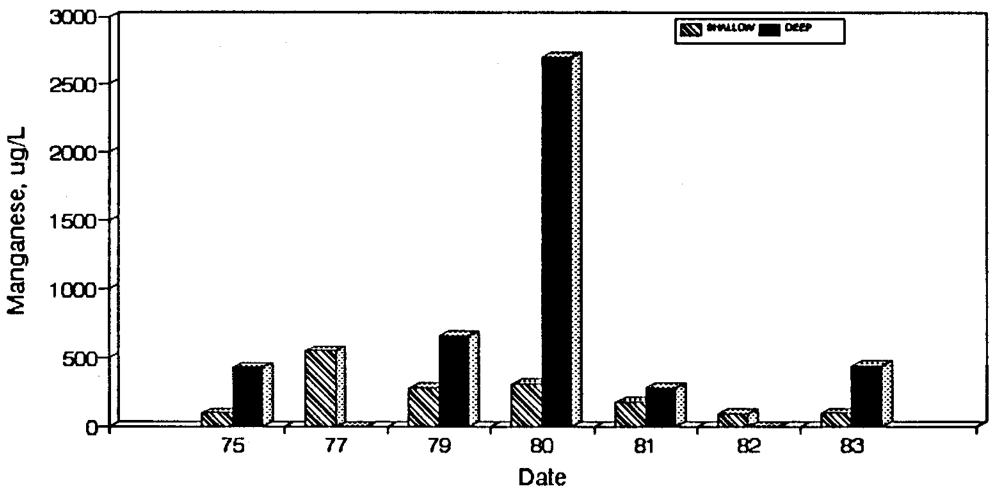

Figure D68. Graph of Manganese vs. Time for the Hwy109 Site-Aug.

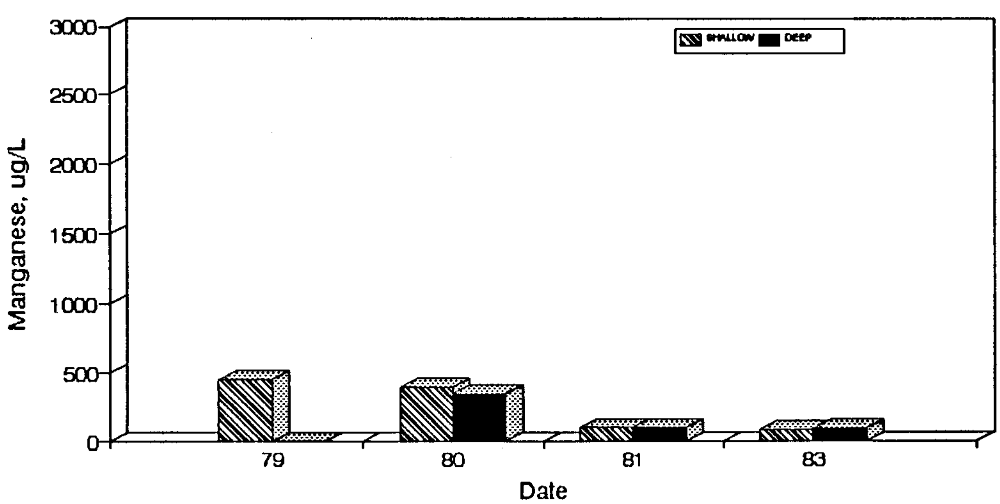

Figure D69. Graph of Manganese vs. Time for the Hwy109 Site-Dec.

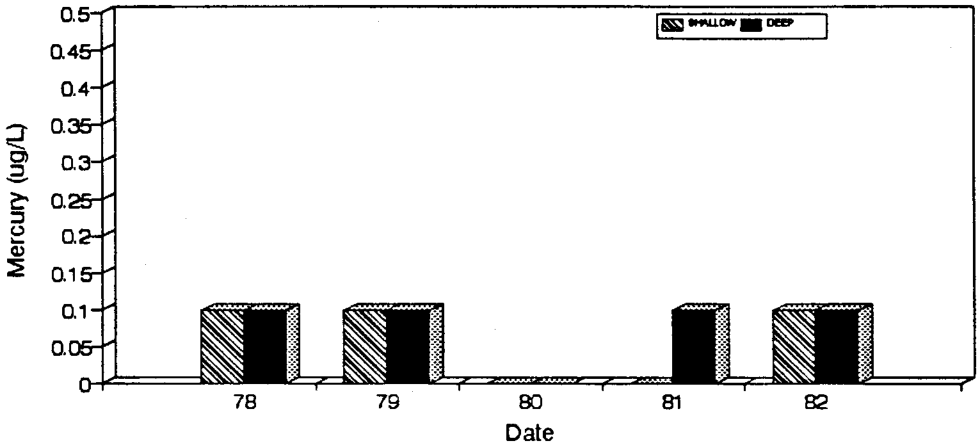

Figure D70. Graph of Mercury vs. Time for the Hwy109 Site-May.

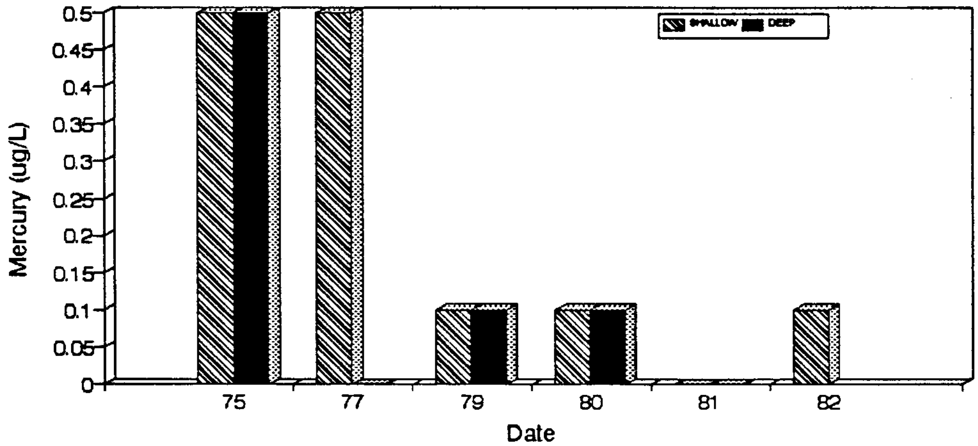

Figure D71. Graph of Mercury vs. Time for the Hwy109 Site-Aug.

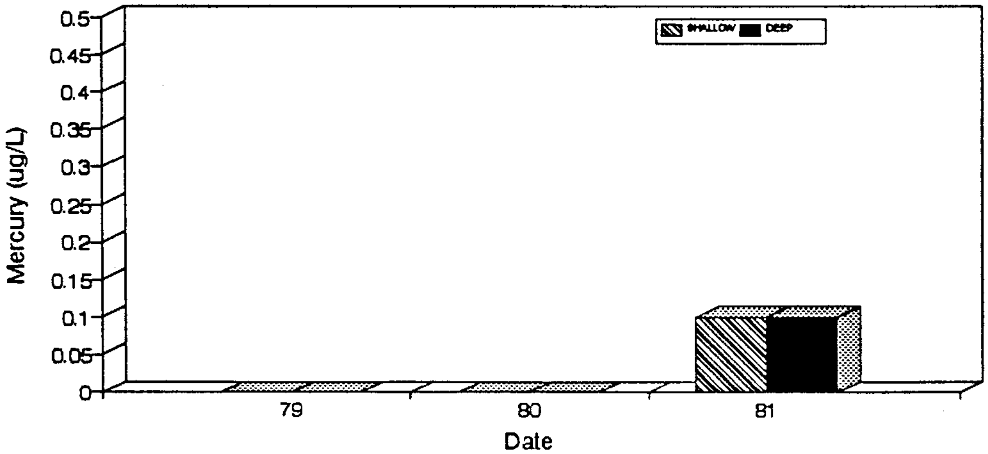

Figure 72. Graph of Mercury vs. Time for the Hwy109 Site-Dec.

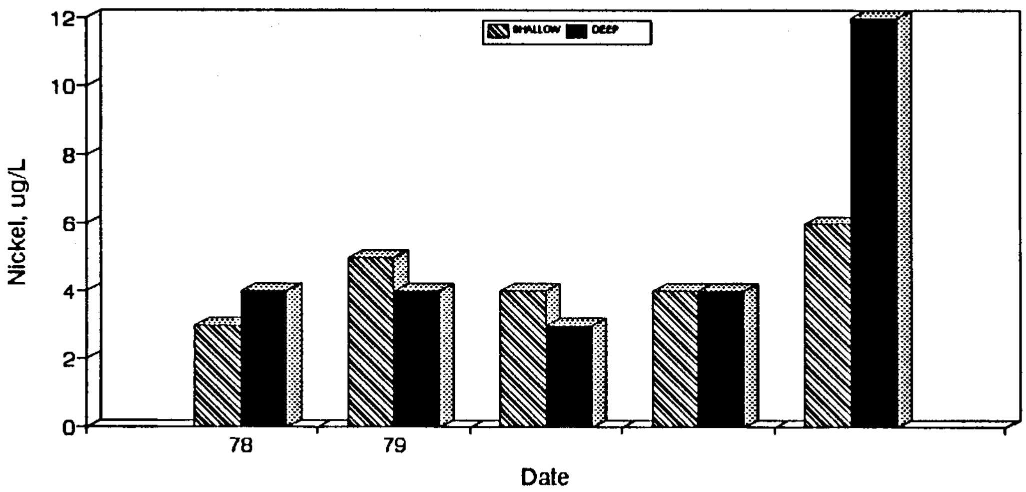

Figure D73. Graph of Nickel vs. Time for the Hwy109 Site-May.

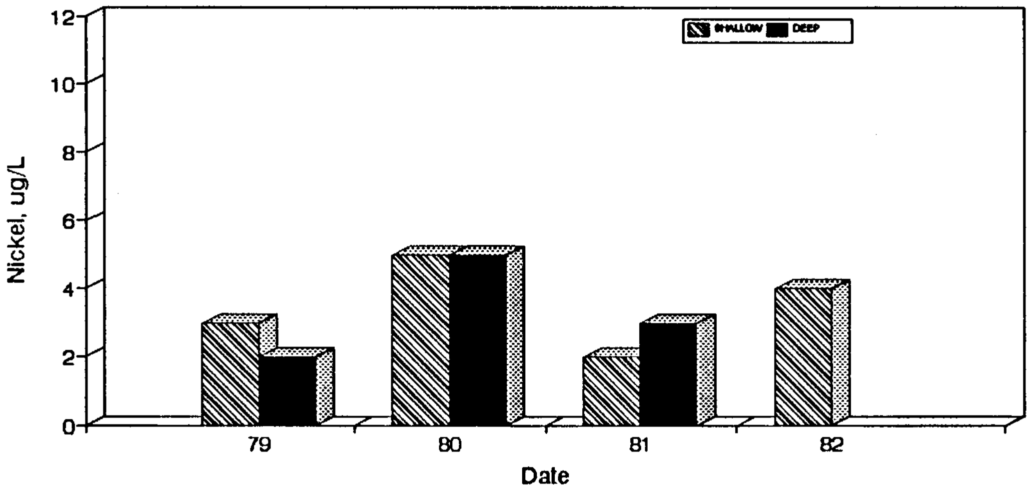

Figure D74. Graph of Nickel vs. Time for the Hwy109 Site-Aug.

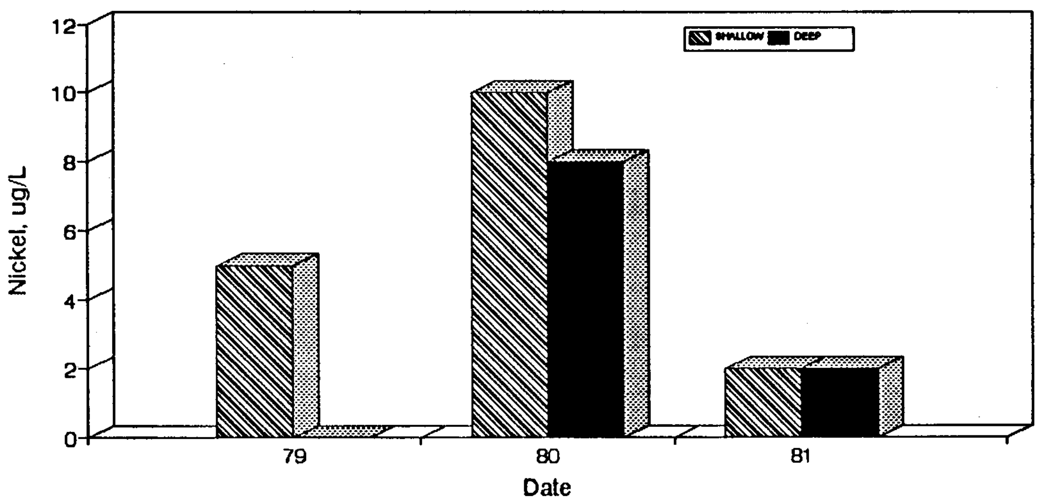

Figure D75. Graph of Nickel vs. Time for the Hwy109 Site-Dec.

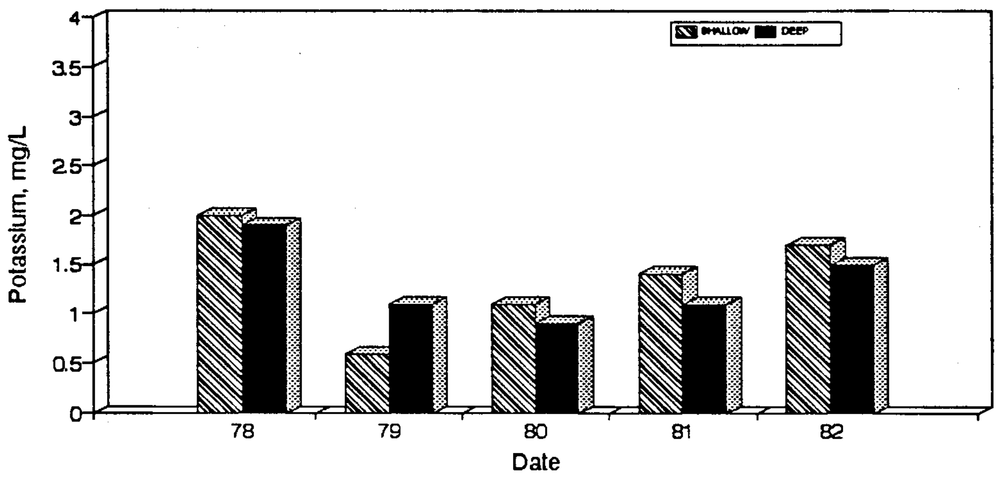

Figure D76. Graph of Potassium vs. Time for the Hwy109 Site-May.

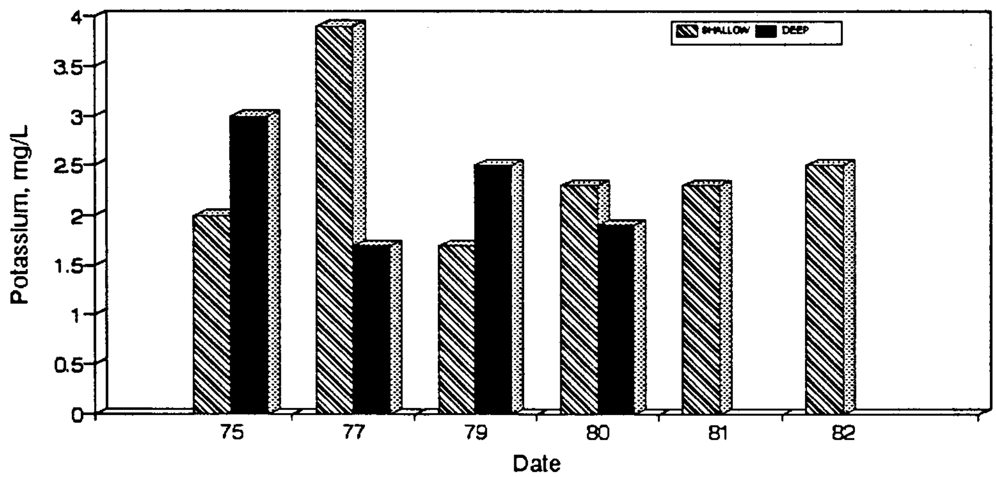

Figure D77. Graph of Potassium vs. Time for the Hwy109 Site-Aug.

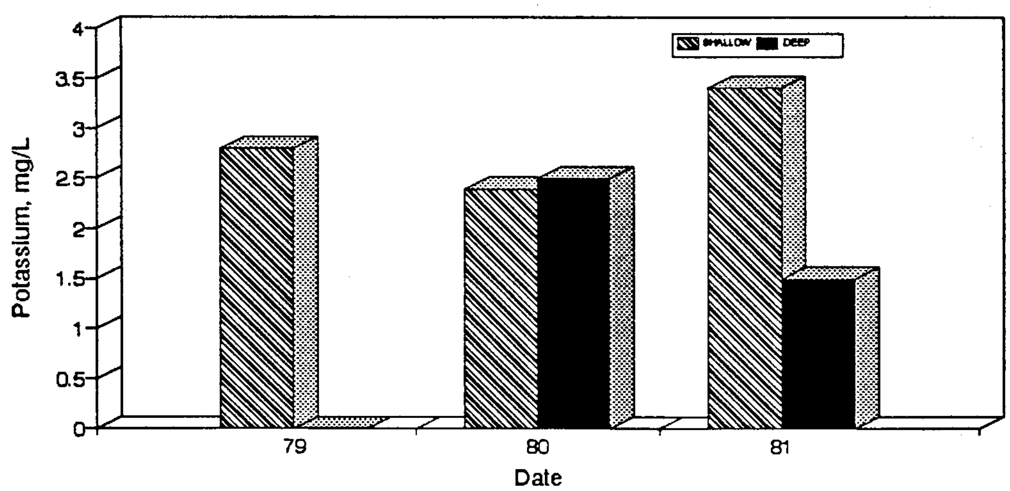

Figure D78. Graph of Potassium vs. Time for the Hwy109 Site-Dec.

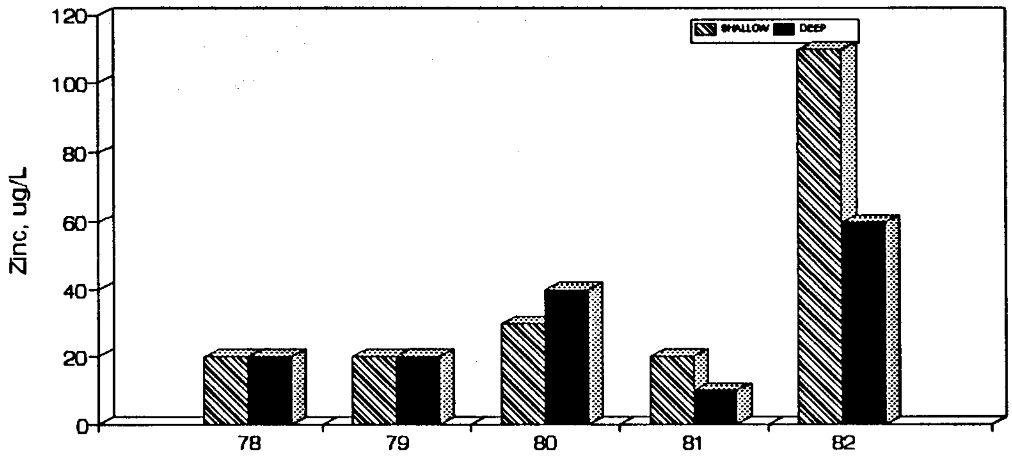

Figure D79. Graph of Zinc vs. Time for the Hwy109 Site-May.

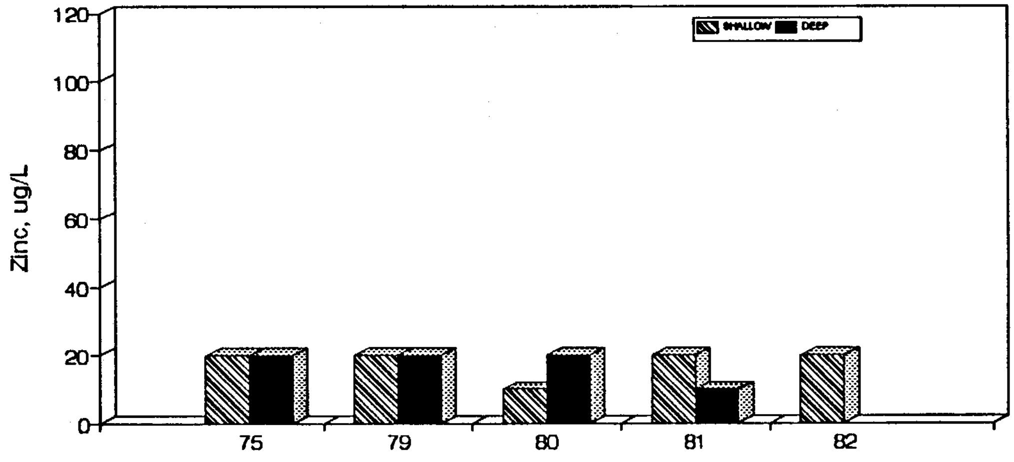

Figure D80. Graph of Zinc vs. Time for the Hwy109 Site-Aug.

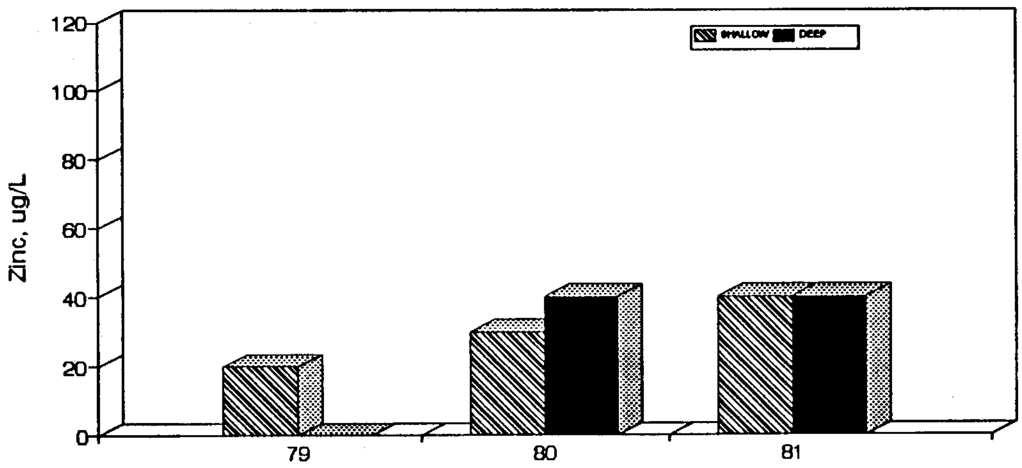

Figure D81. Graph of Zinc vs. Time for the Hwy109 Site-Dec.

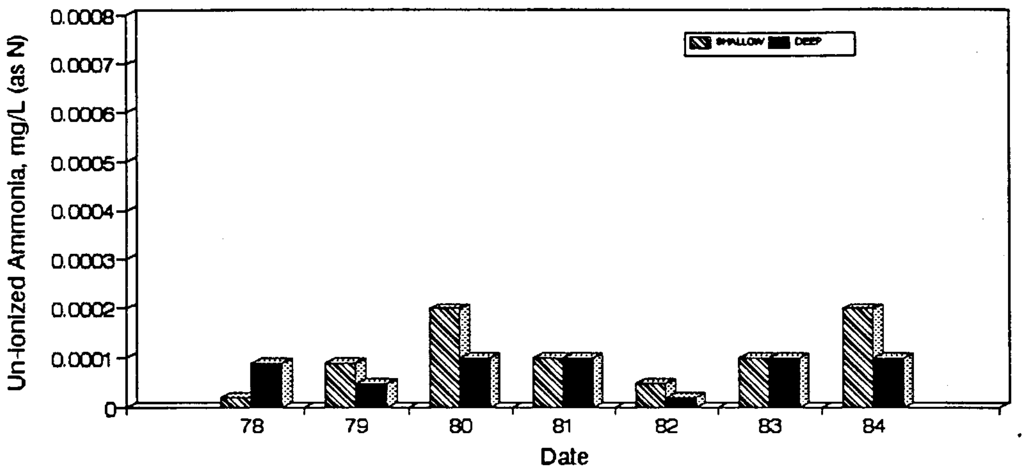

Figure D82. Graph of Un-ionized Ammonia vs. Time for the Hwy109 Site-May.

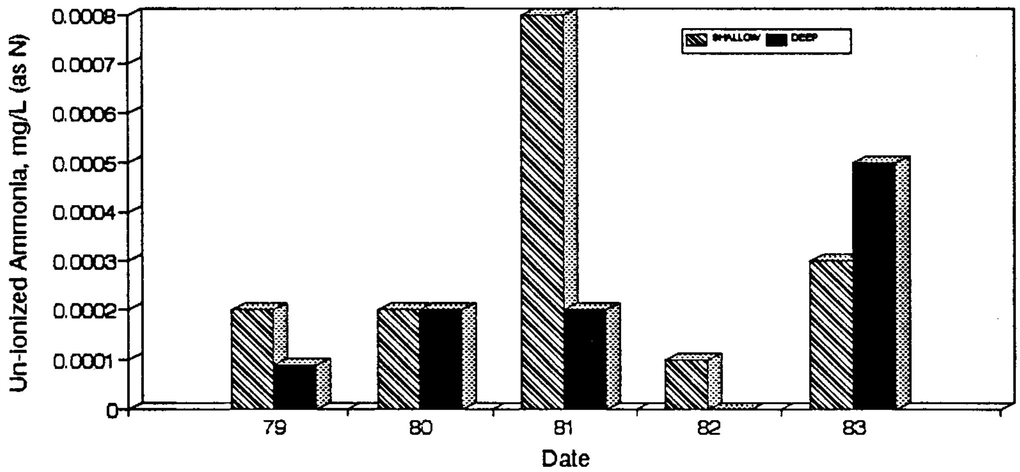

Figure D83. Graph of Un-ionized Ammonia vs. Time for the Hwy109 Site-Aug.

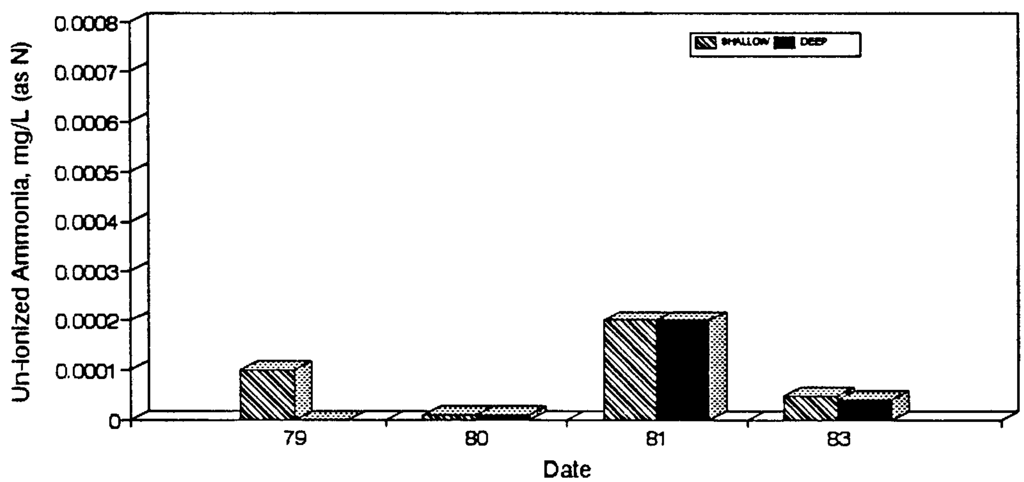

Figure D84. Graph of Un-ionized Ammonia vs. Time for the Hwy109 Site-Dec.

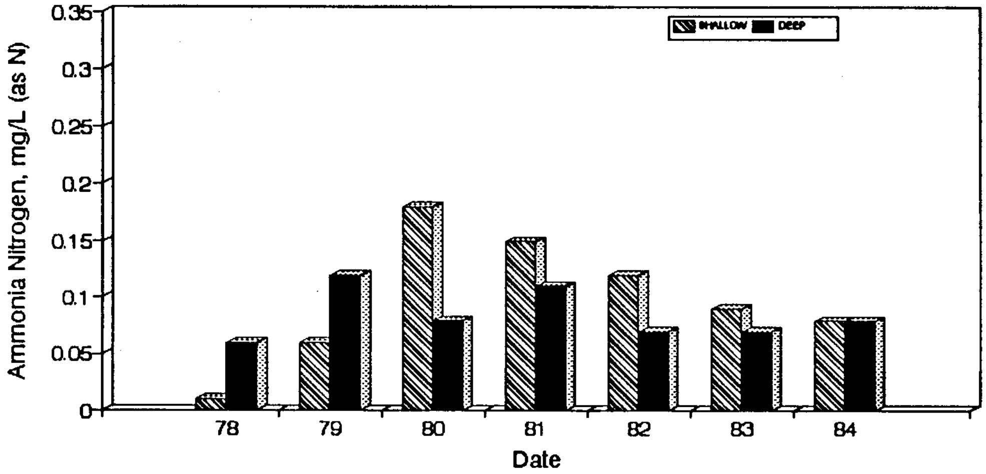

Figure D85. Graph of Ammonia Nitrogen vs. Time for the Hwy109 Site-May.

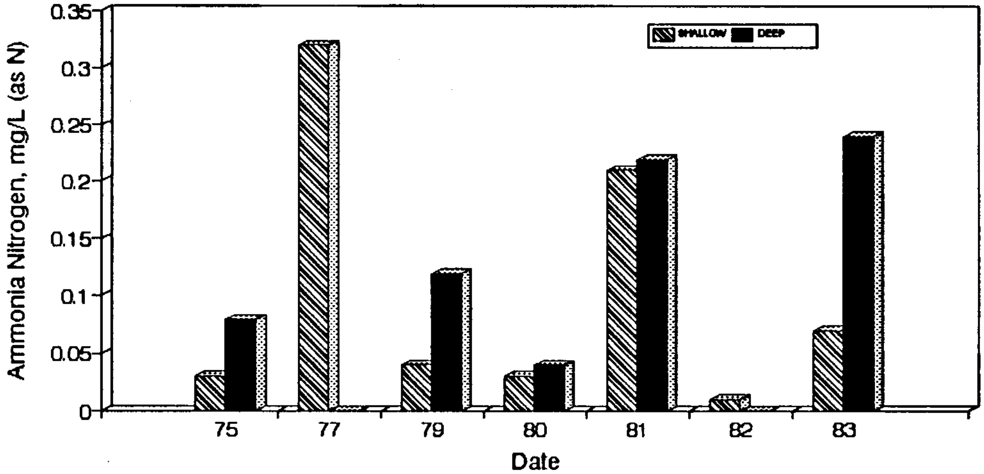

Figure D86. Graph of Ammonia Nitrogen vs. Time for the Hwy109 Site-Aug.

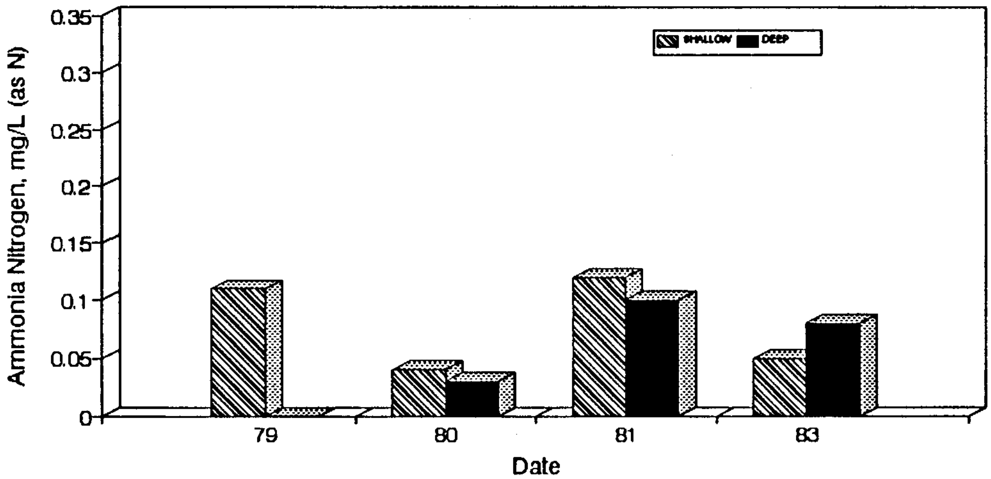

Figure D87. Graph of Ammonia Nitrogen vs. Time for the Hwy109 Site-Dec.

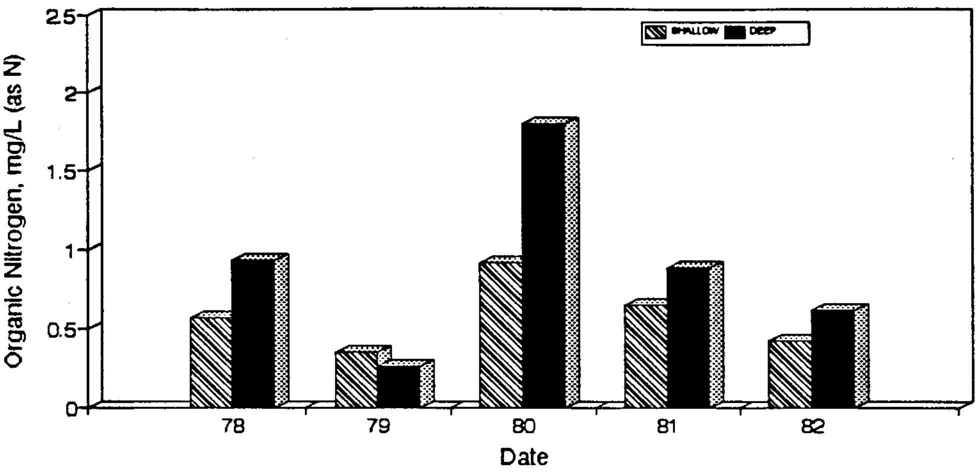

Figure D88. Graph of Organic Nitrogen vs. Time for the Hwy109 Site-May.

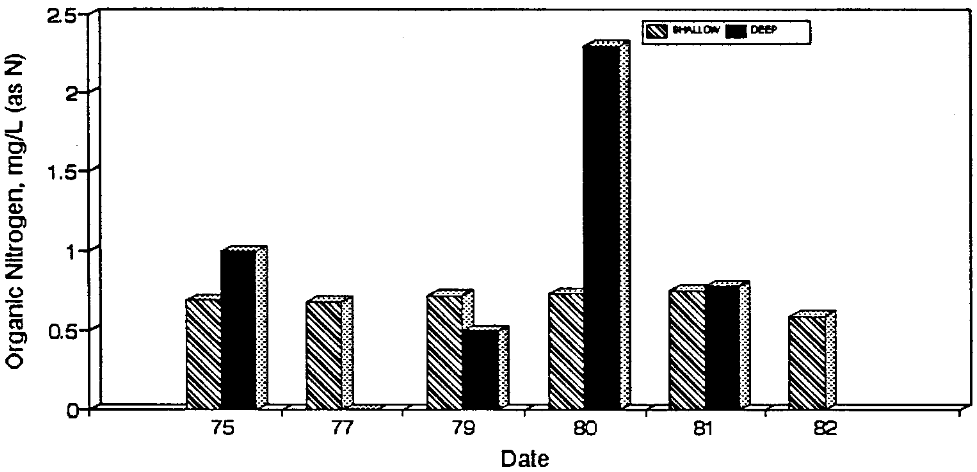

Figure D89. Graph of Organic Nitrogen vs. Time for the Hwy109 Site-Aug.

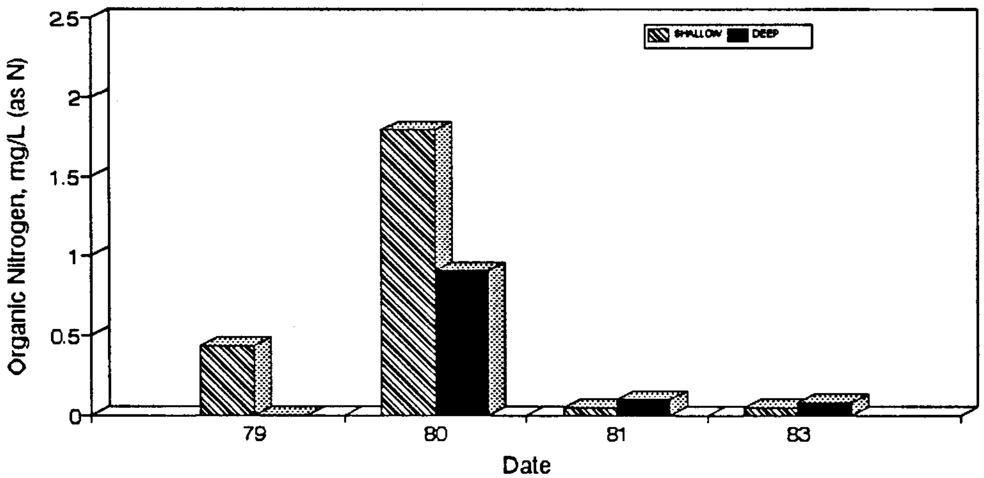

Figure D90. Graph of Organic Nitrogen vs. Time for the Hwy109 Site-Dec.

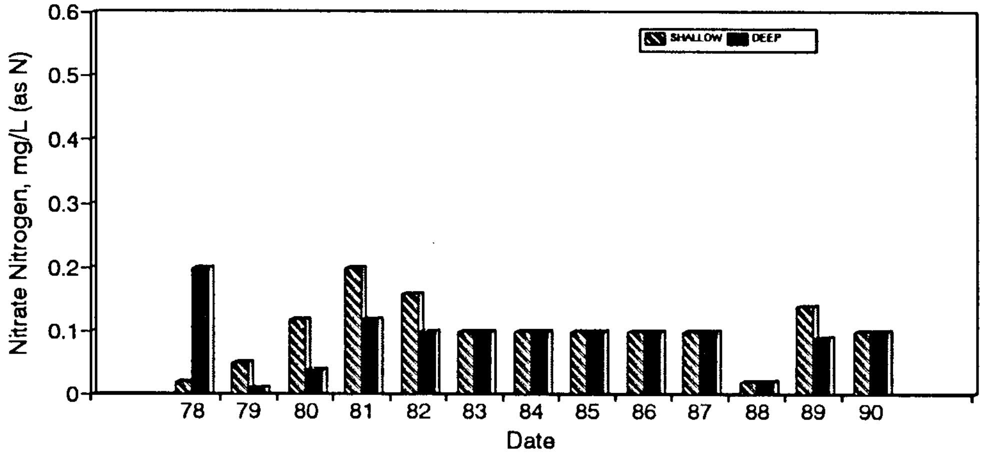

Figure D91. Graph of Nitrate Nitrogen vs. Time for the Hwy109 Site-May.

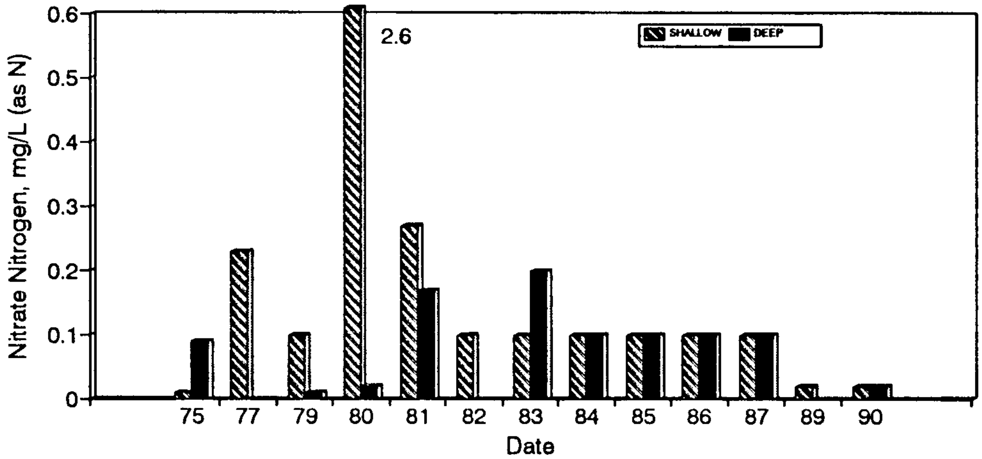

Figure D92. Graph of Nitrate Nitrogen vs. Time for the Hwy109 Site-Aug.

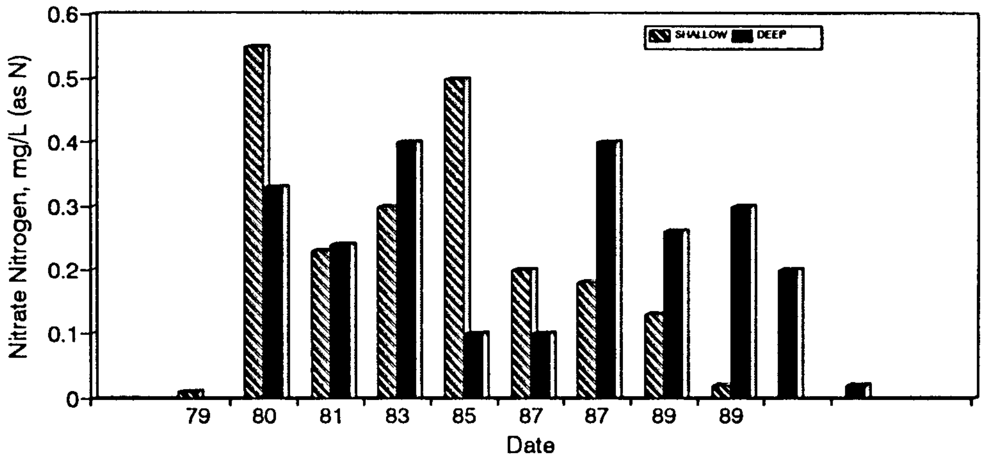

Figure D93. Graph of Nitrate Nitrogen vs. Time for the Hwy109 Site-Dec.

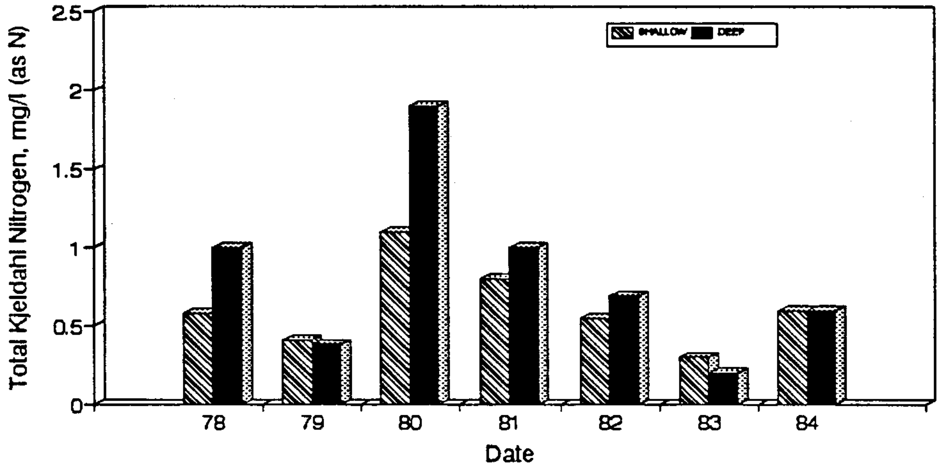

Figure D94. Graph of Total Kjeldahl Nitrogen vs. Time for the Hwy109 Site-May.

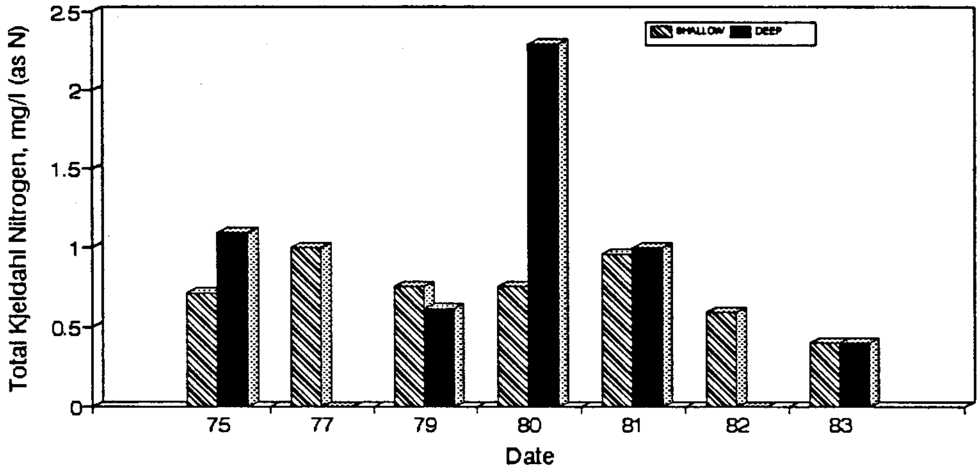

Figure D95. Graph of Total Kjeldahl Nitrogen vs. Time for the Hwy109 Site-Aug.

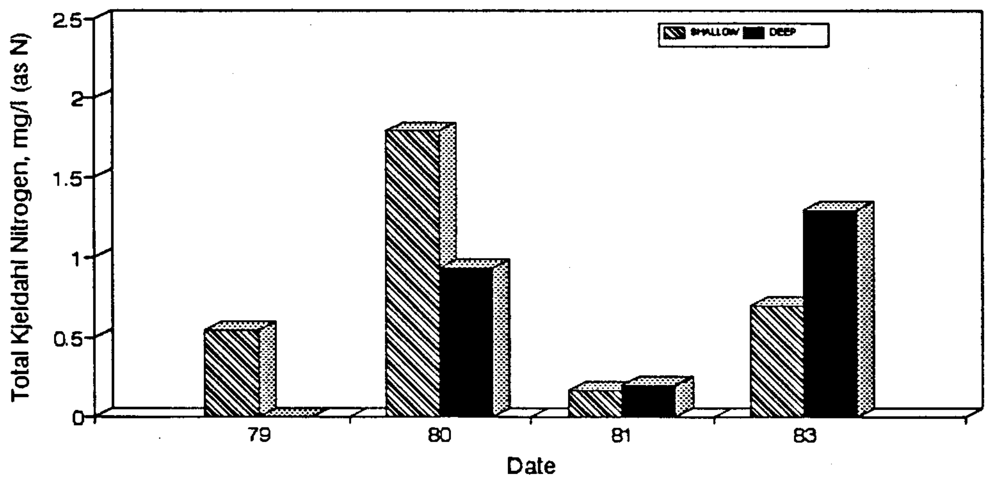

Figure D96. Graph of Total Kjeldahl Nitrogen vs. Time for the Hwy109 Site-Dec.

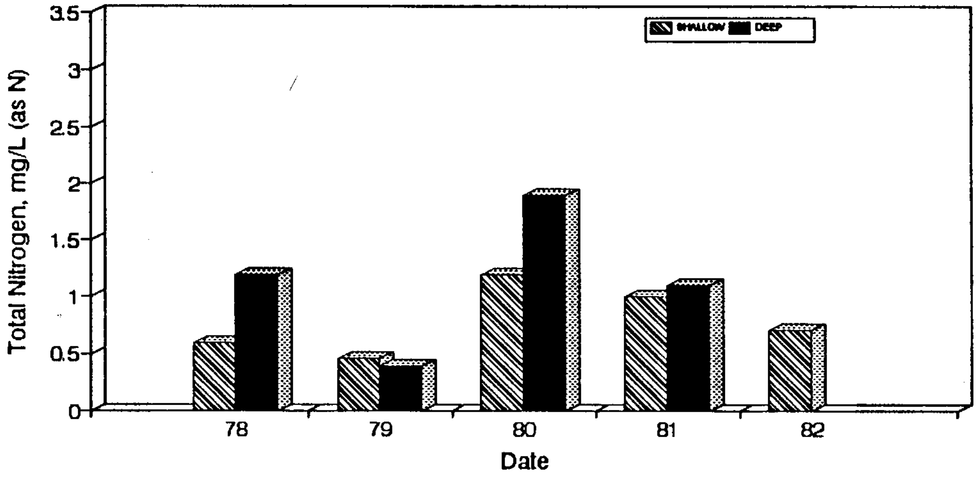

Figure D97. Graph of Total Nitrogen vs. Time for the Hwy109 Site-May.

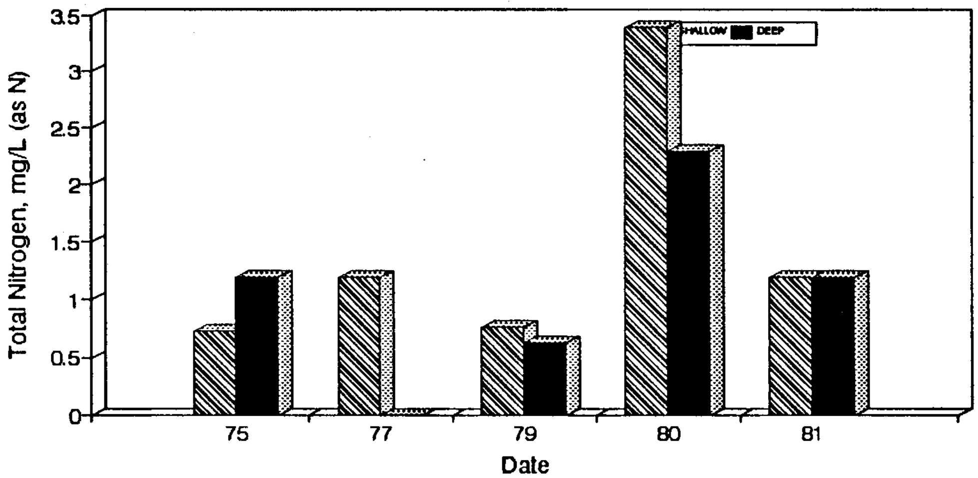

Figure D98. Graph of Total Nitrogen vs. Time for the Hwy109 Site-Aug.

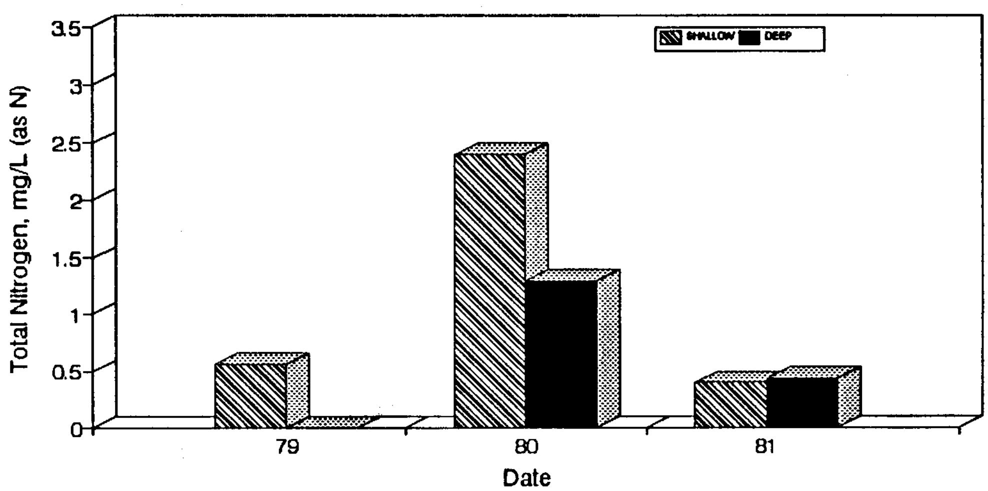

Figure D99. Graph of Total Nitrogen vs. Time for the Hwy109 Site-Dec.

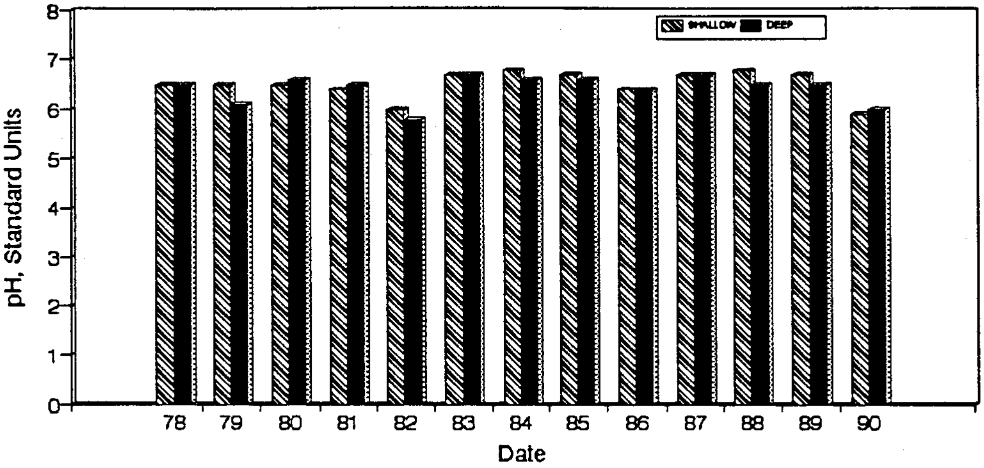

Figure D100. Graph of pH vs. Time for the Hwy109 Site-May.

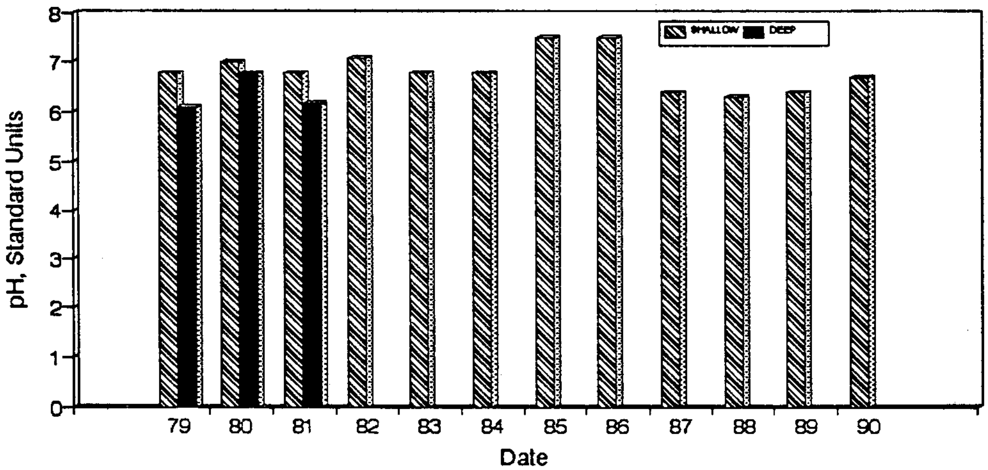

Figure D101. Graph of pH vs. Time for the Hwy109 Site-Aug.

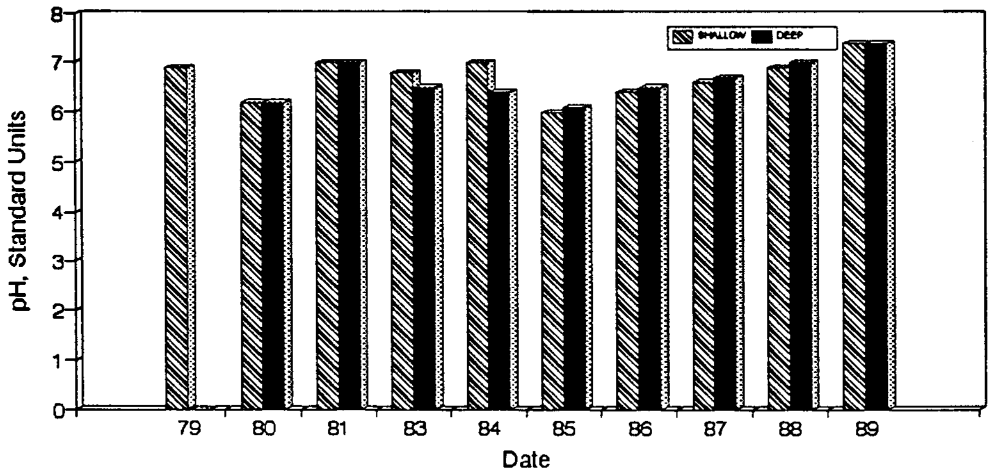

Figure D102. Graph of pH vs. Time for the Hwy109 Site-Dec.

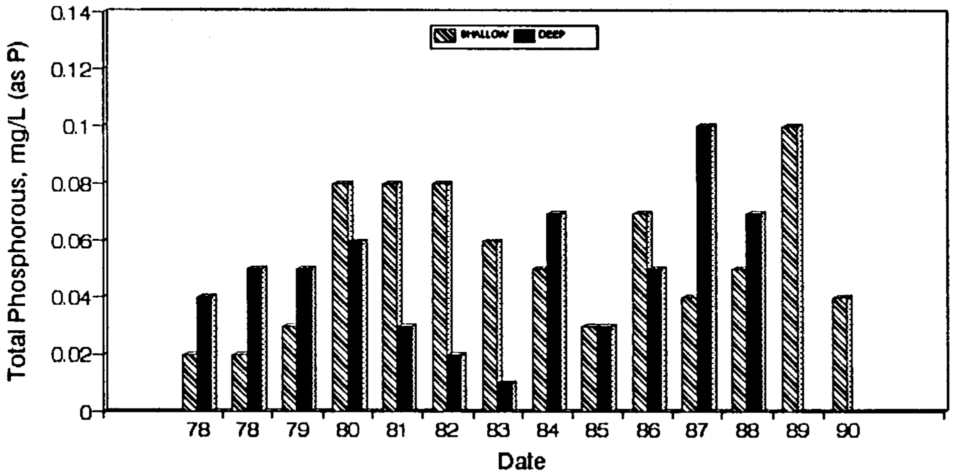

Figure D103. Graph of Total Phosphorous vs. Time for the Hwy109 Site-May.

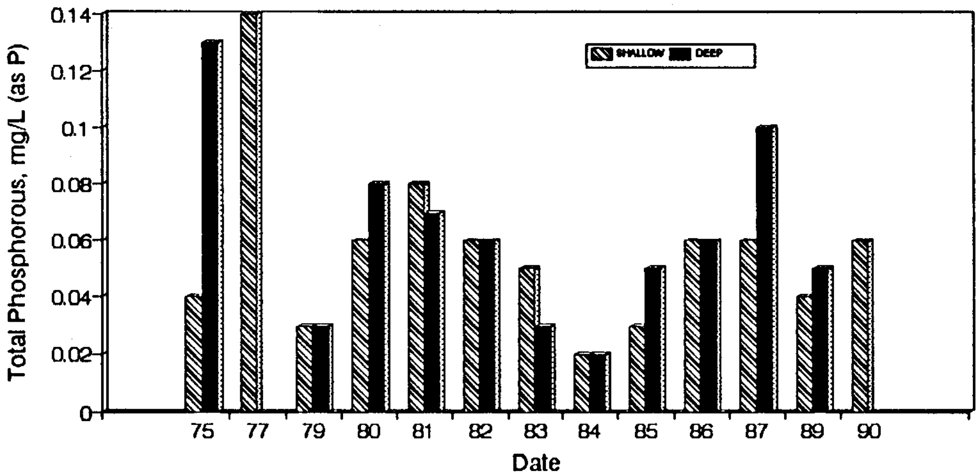

Figure D104. Graph of Total Phosphorous vs. Time for the Hwy109 Site-Aug.

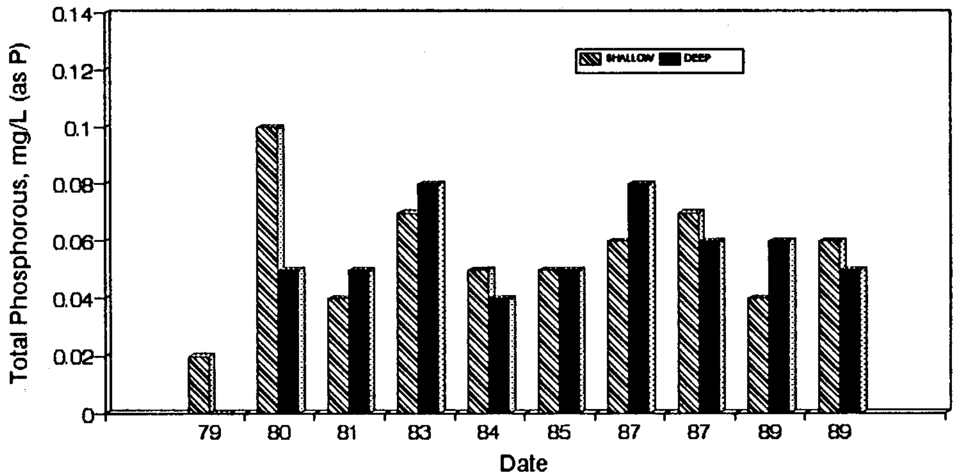

Figure D105. Graph of Total Phosphorous vs. Time for the Hwy109 Site-Dec.

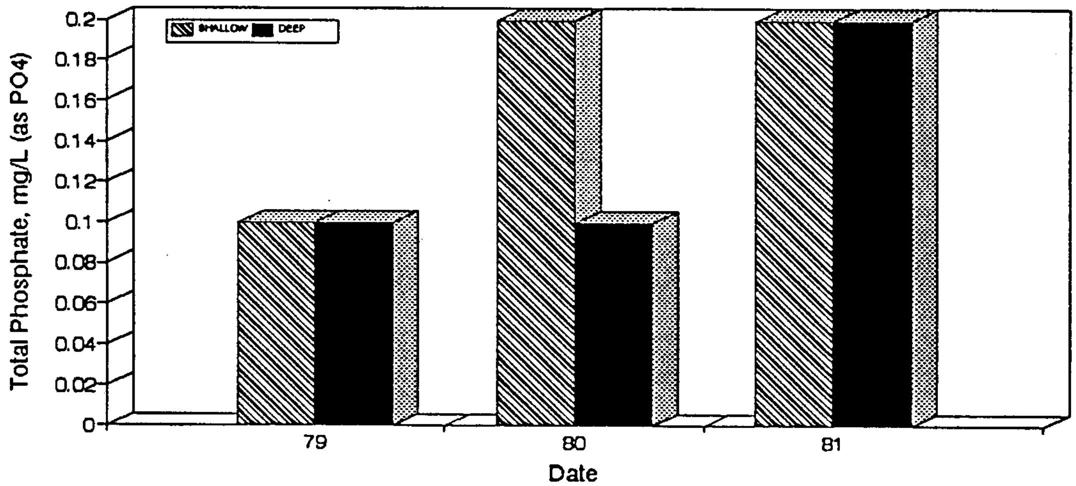

Figure D106. Graph of Total Phosphate vs. Time for the Hwy109 Site-May.

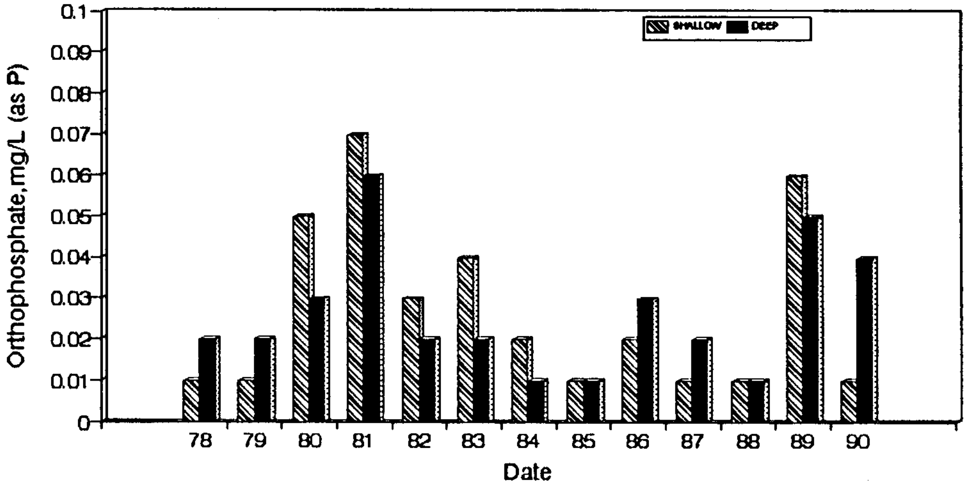

Figure D107. Graph of Orthophosphate vs. Time for the Hwy109 Site-May.

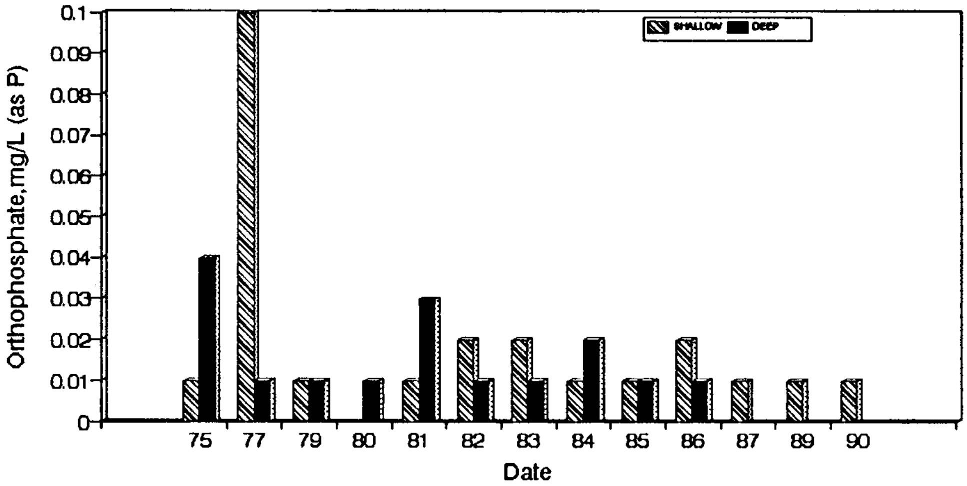

Figure D108. Graph of Orthophosphate vs. Time for the Hwy109 Site-Aug.

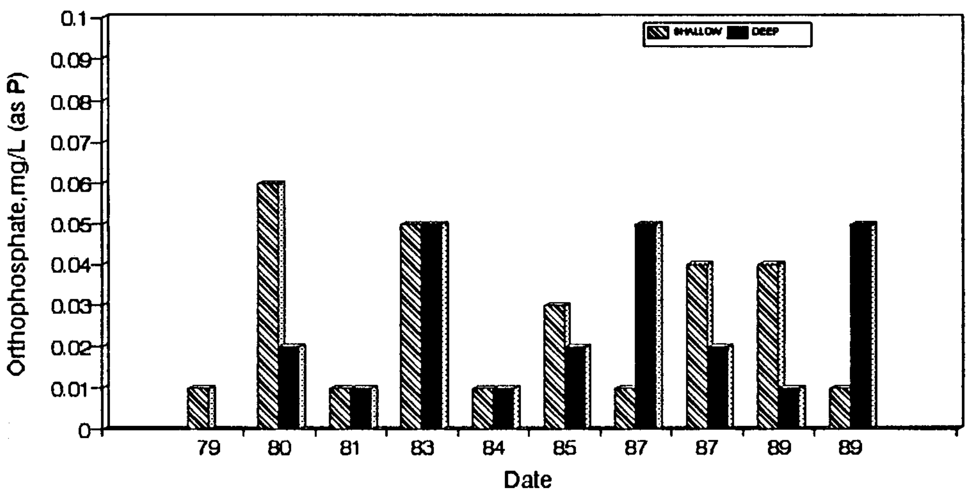

Figure D109. Graph of Orthophosphate vs. Time for the Hwy109 Site-Dec.

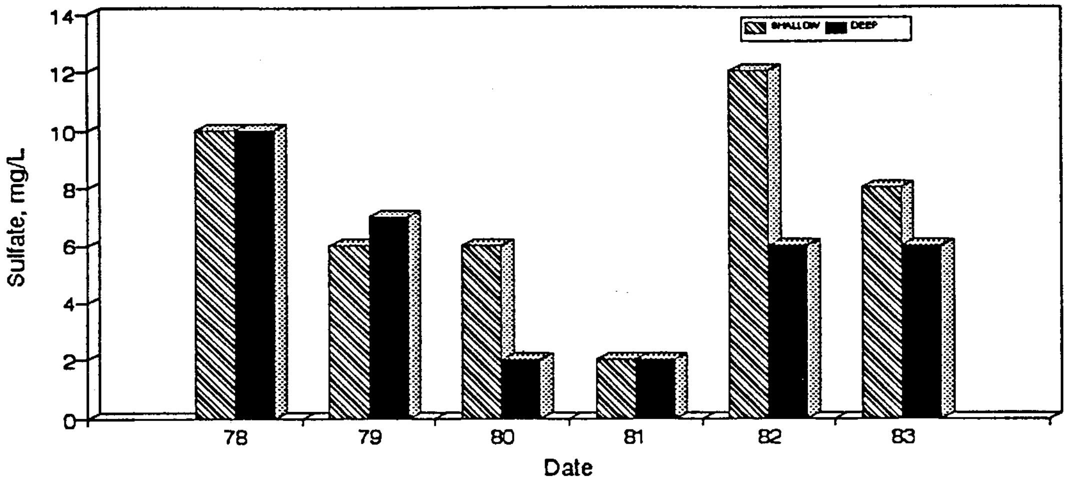

Figure D110. Graph of Sulfate vs. Time for the Hwy109 Site-May.

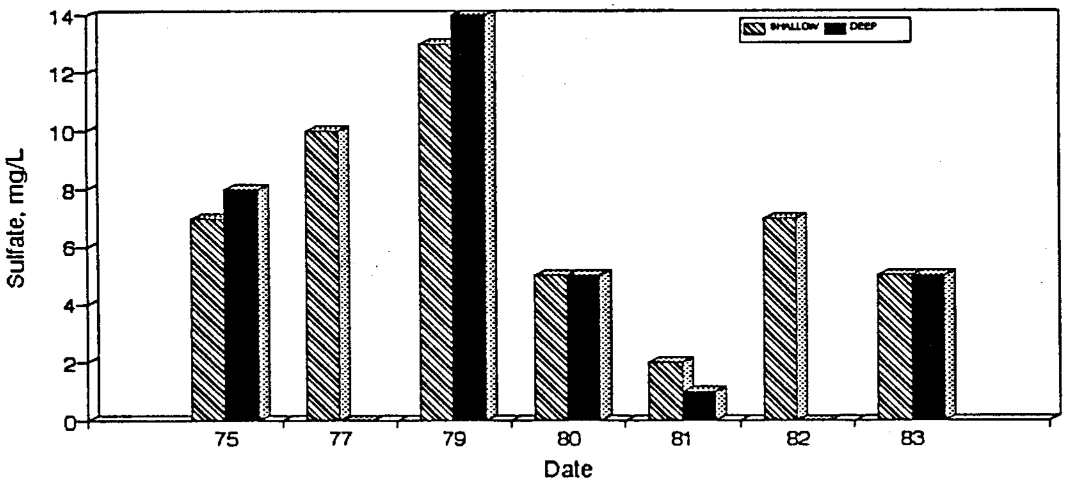

Figure D111. Graph of Sulfate vs. Time for the Hwy109 Site-Aug.

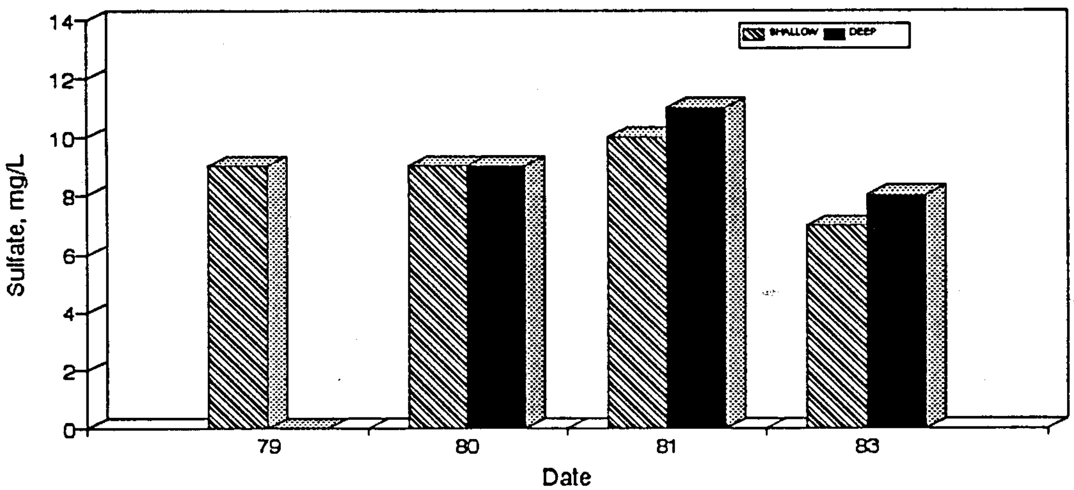

Figure D112. Graph of Sulfate vs. Time for the Hwy109 Site-Dec.

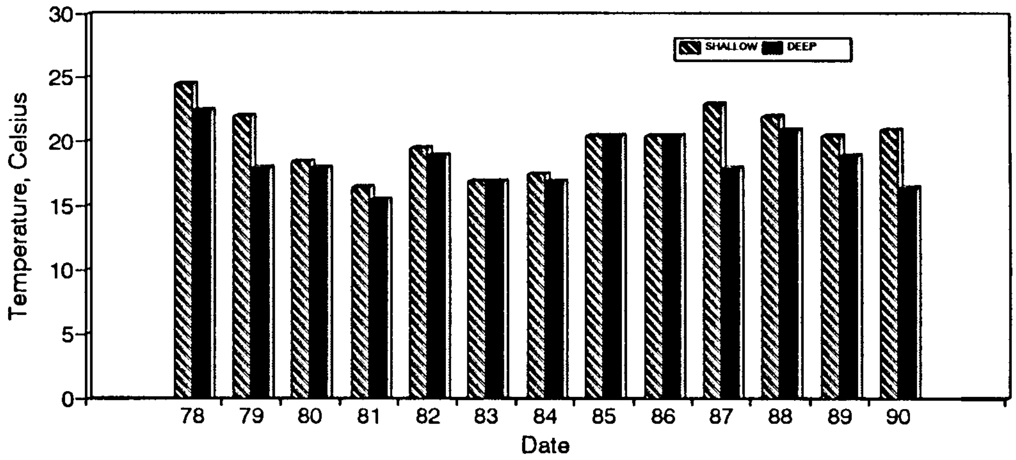

Figure D113. Graph of Temperature vs. Time for the Hwy109 Site-May.

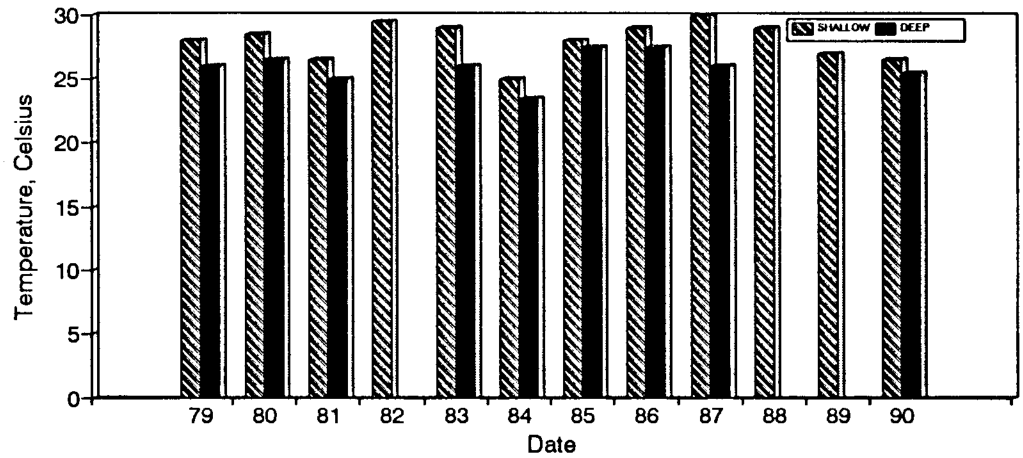

Figure D114. Graph of Temperature vs. Time for the Hwy109 Site-Aug.

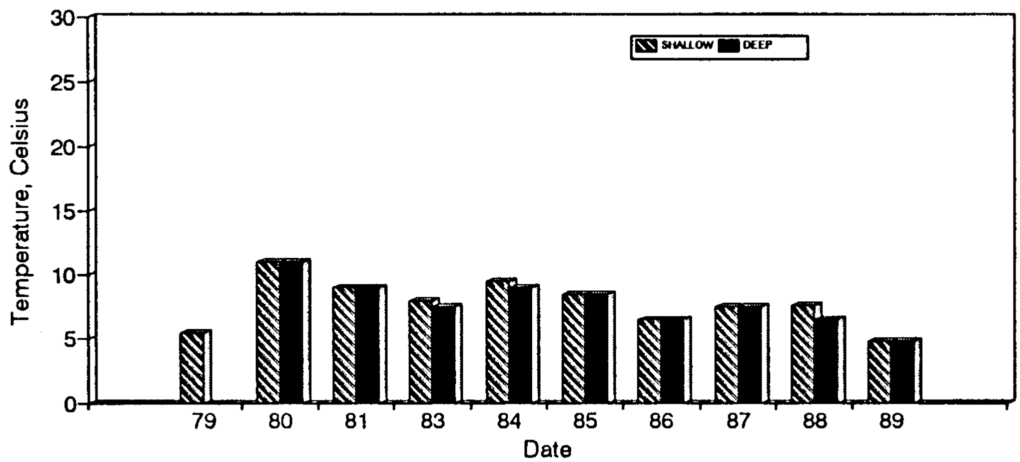

Figure D115. Graph of Temperature vs. Time for the Hwy109 Site-Dec.

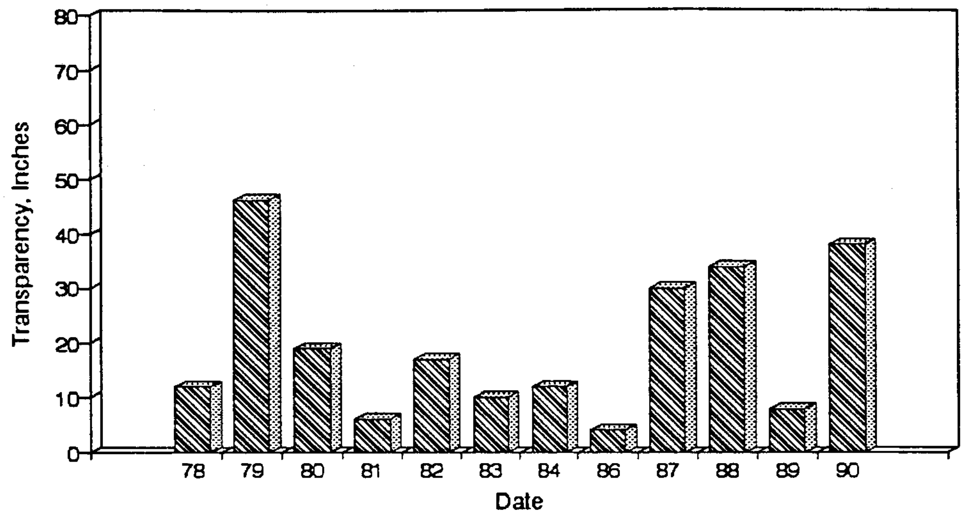

Figure D116. Graph of Transparency vs. Time for the Hwy109 Site-May.

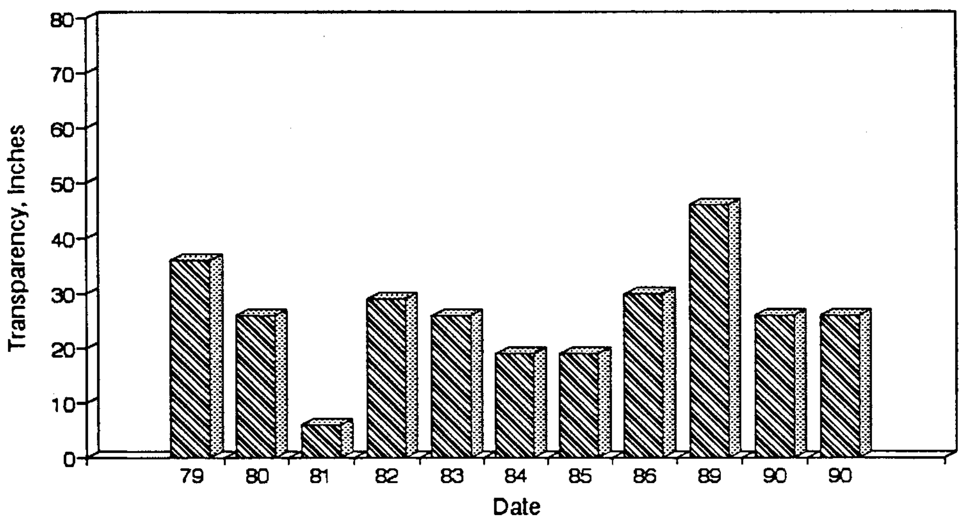

Figure D117. Graph of Transparency vs. Time for the Hwy109 Site-Aug.

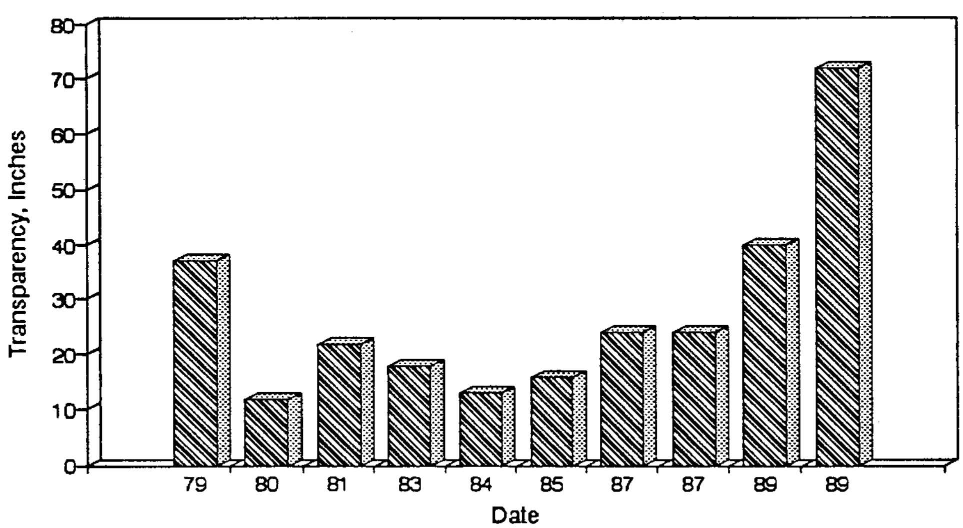

Figure D118. Graph of Transparency vs. Time for the Hwy109 Site-Dec.

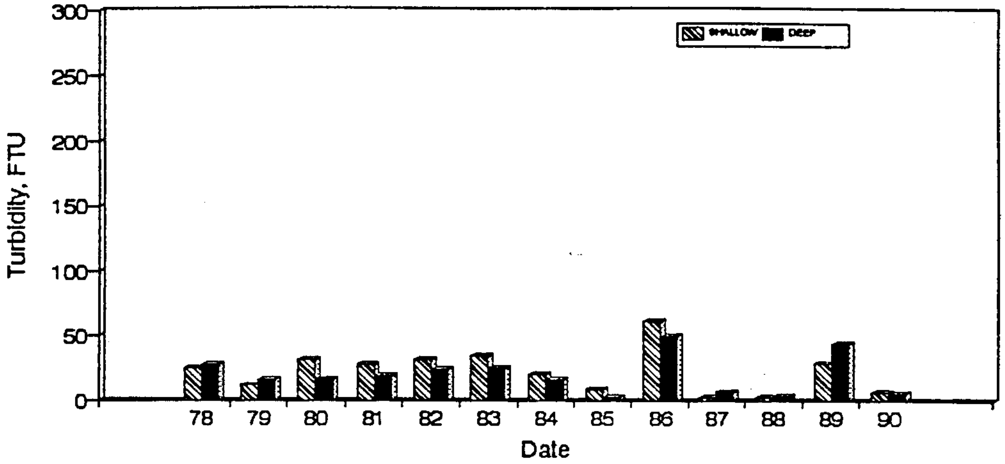

Figure D119. Graph of Turbidity vs. Time for the Hwy109 Site-May.

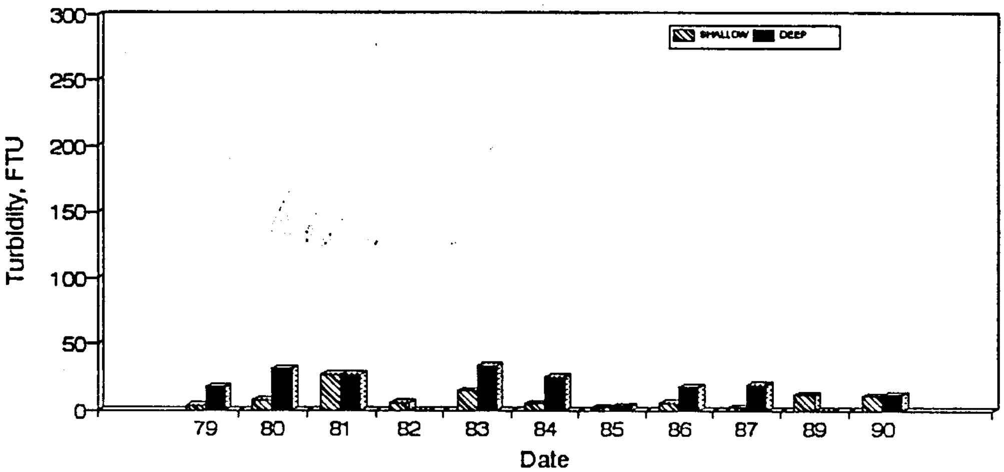

Figure D120. Graph of Turbidity vs. Time for the Hwy109 Site-Aug.

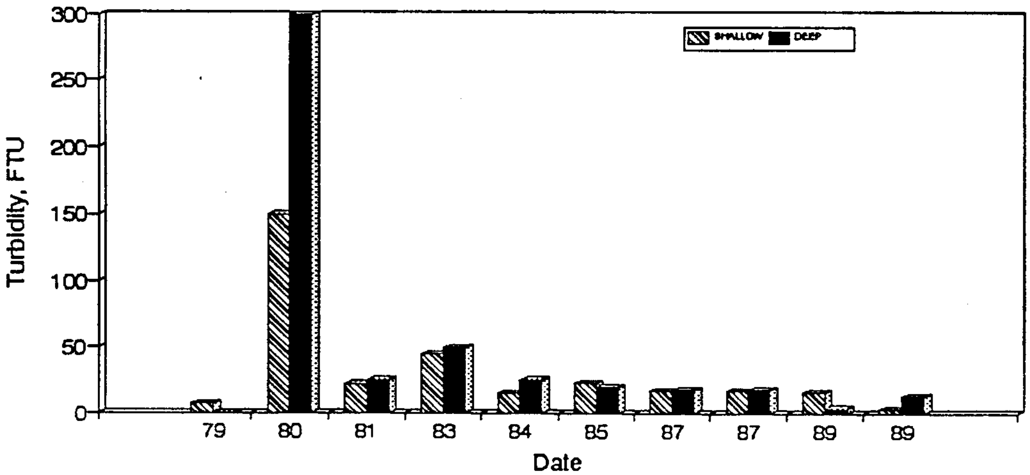

Figure D121. Graph of Turbidity vs. Time for the Hwy109 Site-Dec.

APPENDIX E

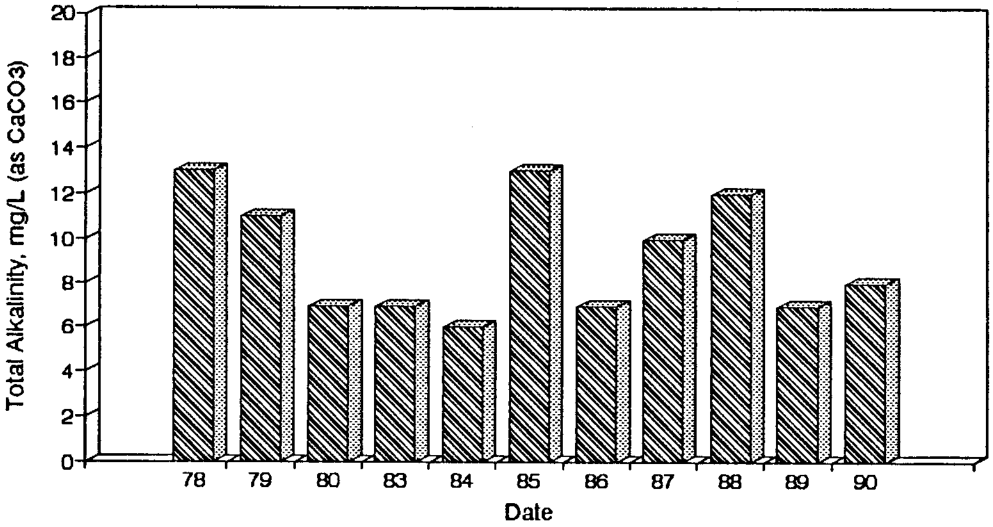

Figure E1. Graph of Total Alkalinity vs. Time for the Sugar Grove Site-May.

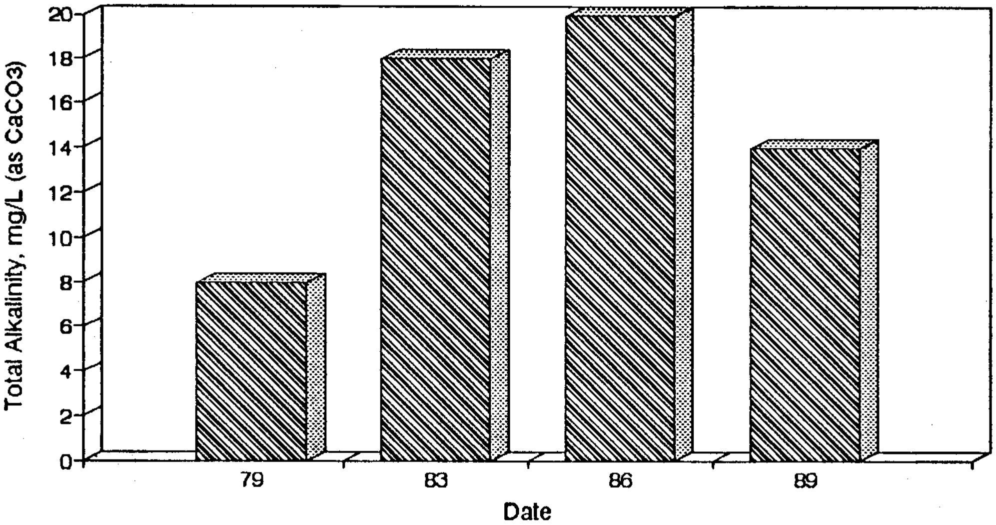

Figure E2. Graph of Total Alkalinity vs. Time for the Sugar Grove Site-Aug.

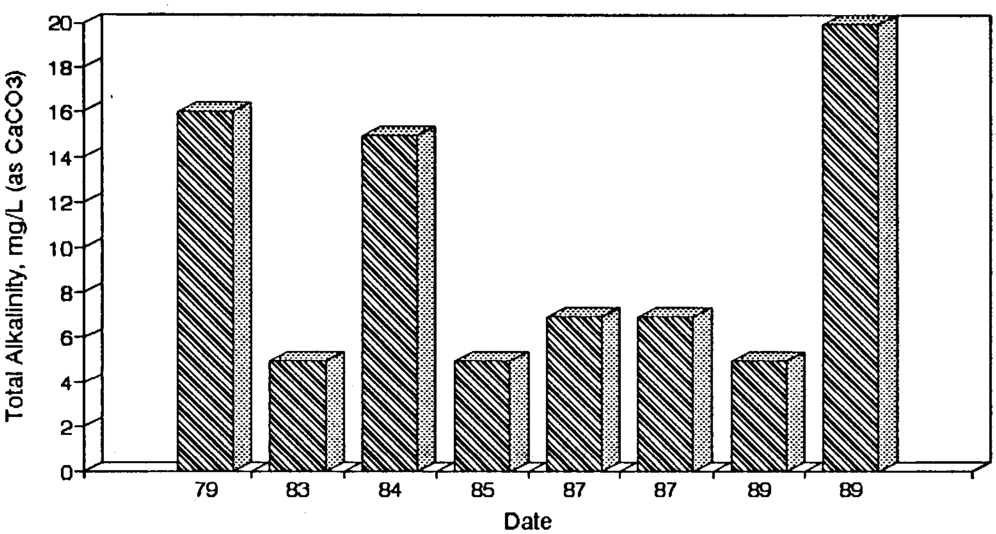

Figure E3. Graph of Total Alkalinity vs. Time for theSugar Grove Site-Dec.

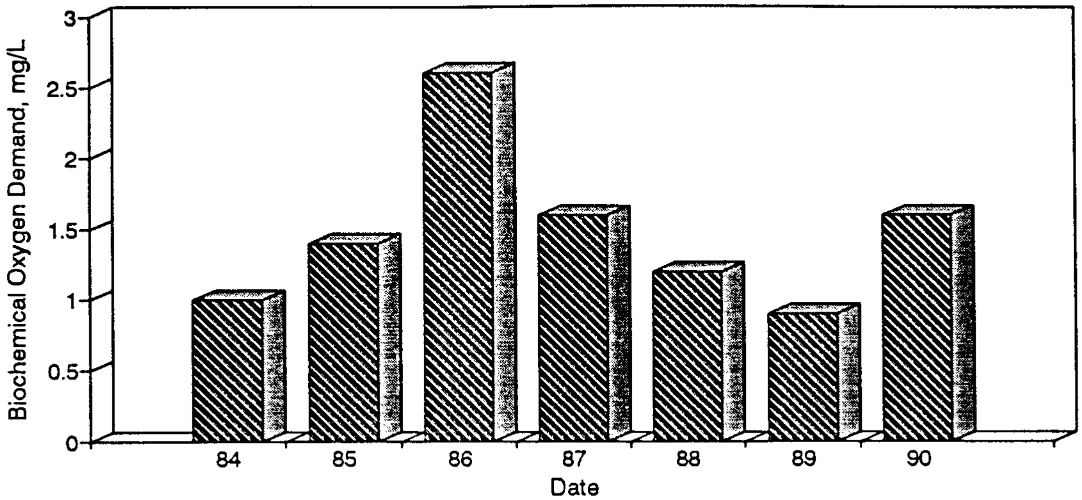

Figure E4. Graph of Biochemical Oxygen Demand vs. Time for the Sugar Grove Site-May.

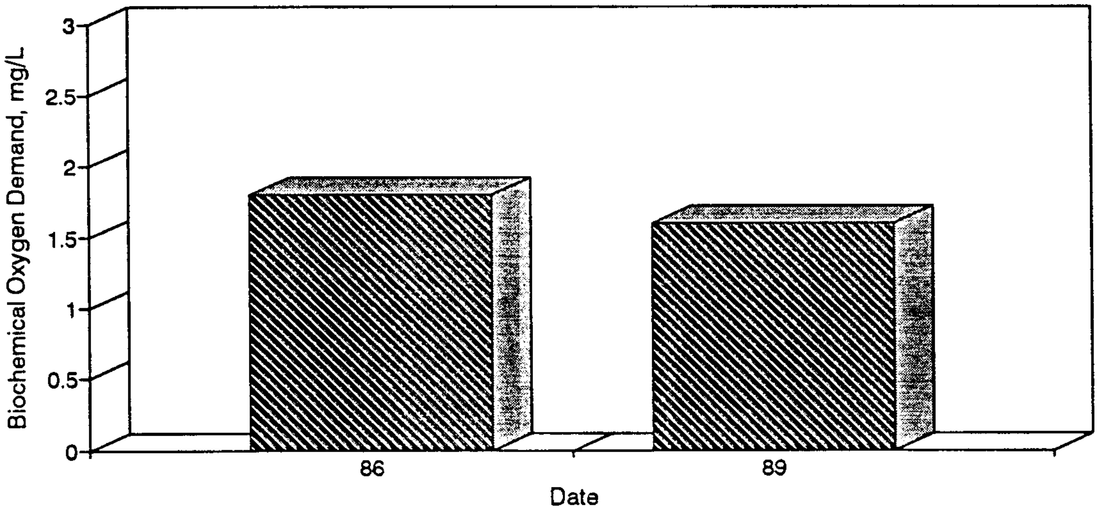

Figure E5. Graph of Biochemical Oxygen Demand vs. Time for the Sugar Grove Site-Aug.

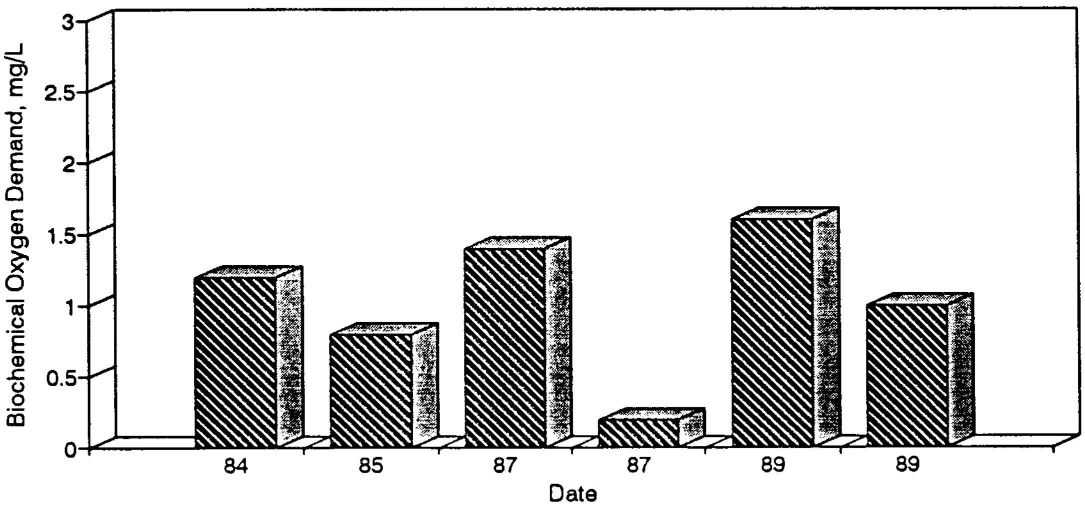

Figure E6. Graph of Biochemical Oxygen Demand vs. Time for the Sugar Grove Site-Dec.

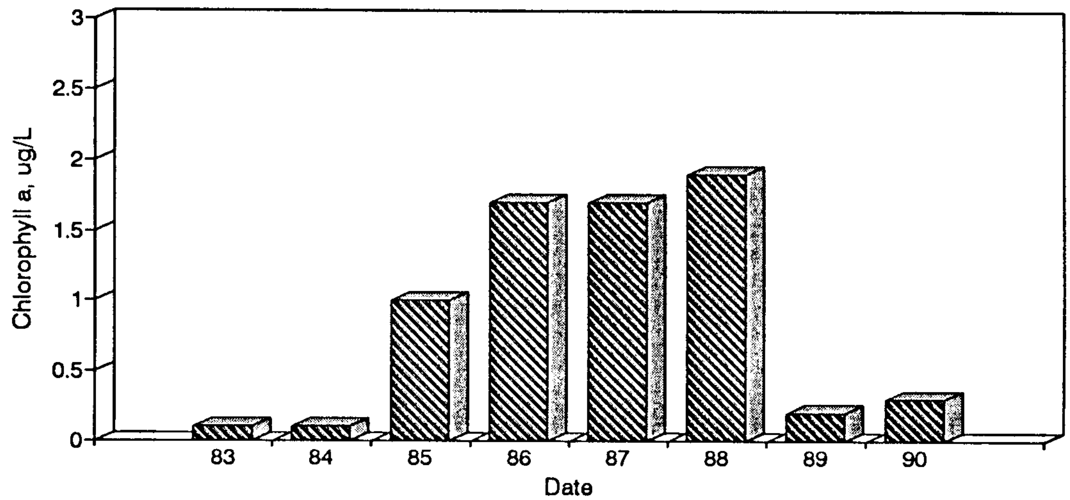

Figure E7. Graph of Chlorophyll a vs. Time for the Sugar Grove Site-May.

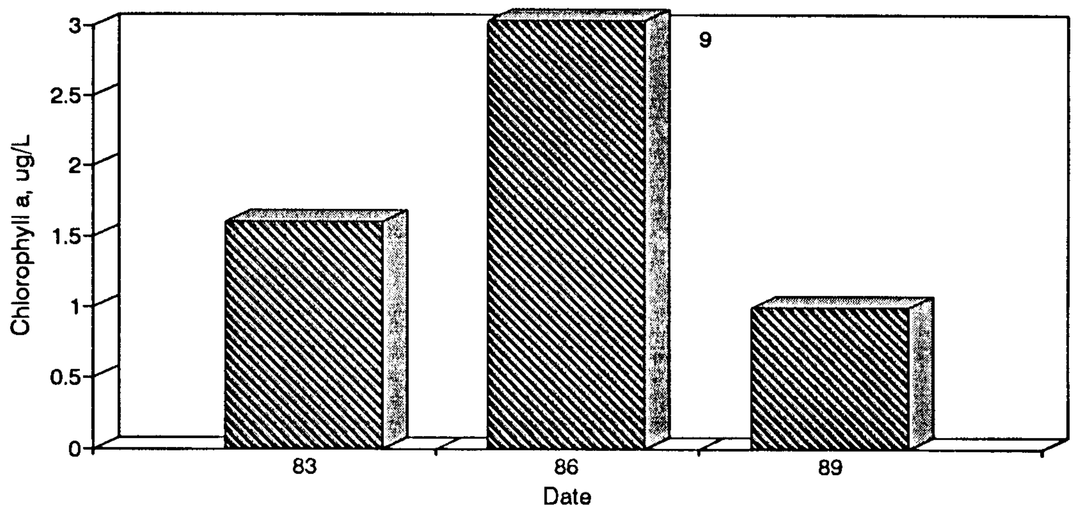

Figure E8. Graph of Chlorophyll a vs. Time for the Sugar Grove Site-Aug.

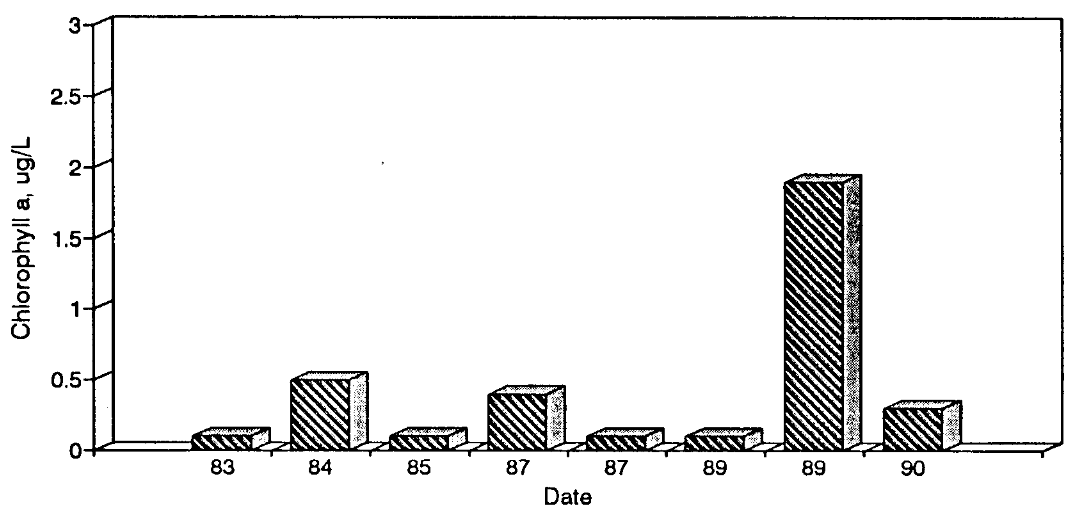

Figure E9. Graph of Chlorophyll a vs. Time for the Sugar Grove Site-Dec.

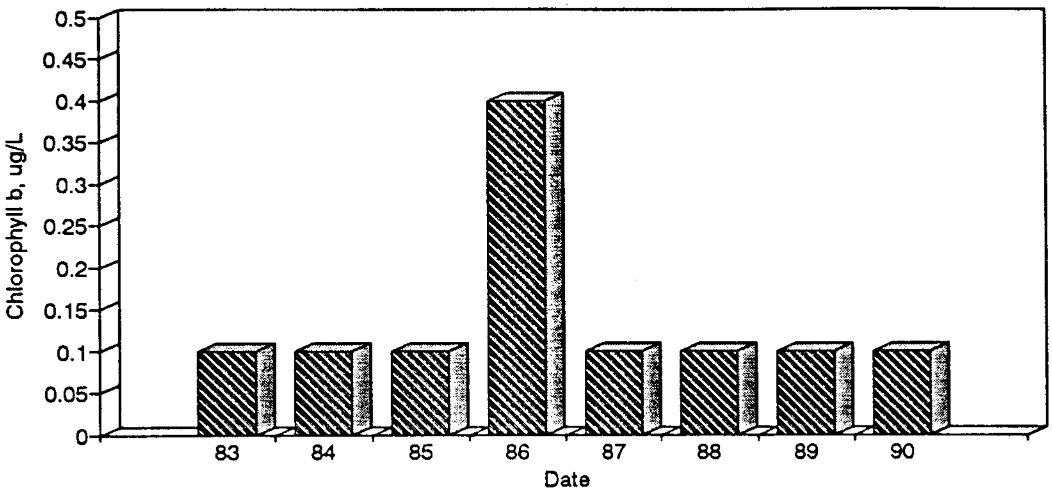

Figure E10. Graph of Chlorophyll b vs. Time for the Sugar Grove Site-May.

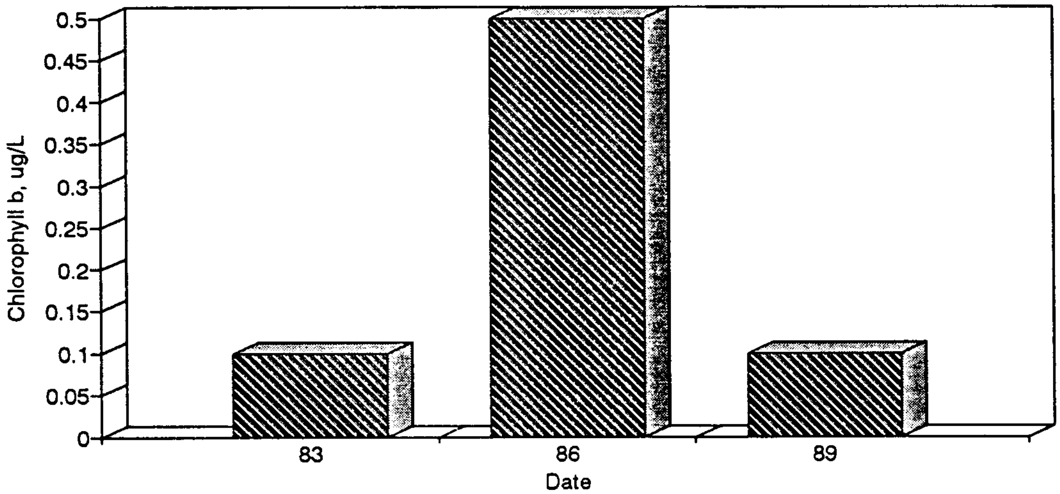

Figure E11. Graph of Chlorophyll b vs. Time for the Sugar Grove Site-Aug.

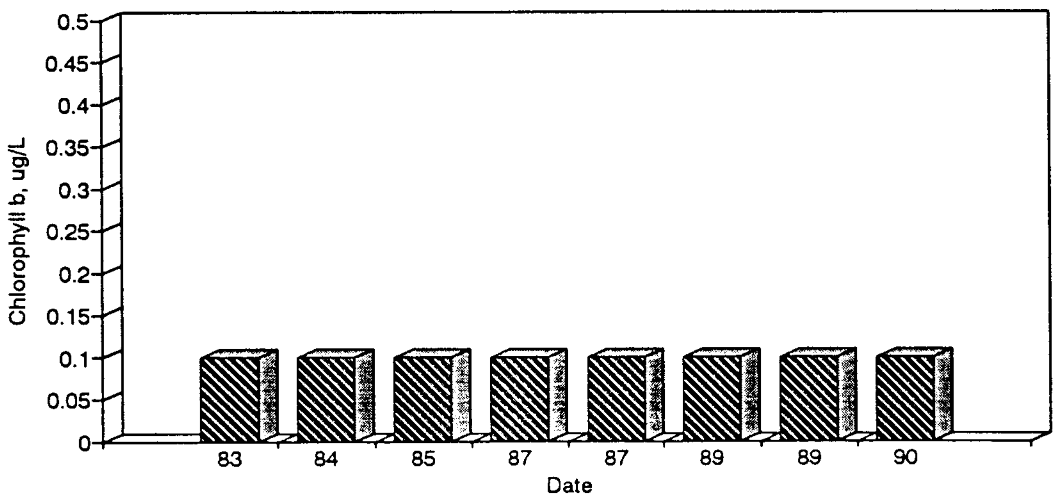

Figure E12. Graph of Chlorophyll b vs. Time for the Sugar Grove Site-Dec.

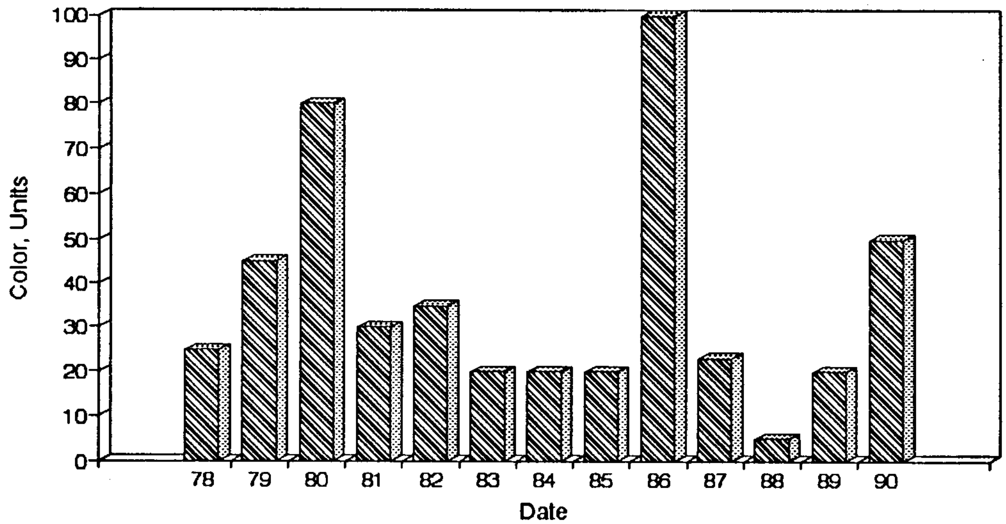

Figure E13. Graph of Color vs. Time for the Sugar Grove Site-May.

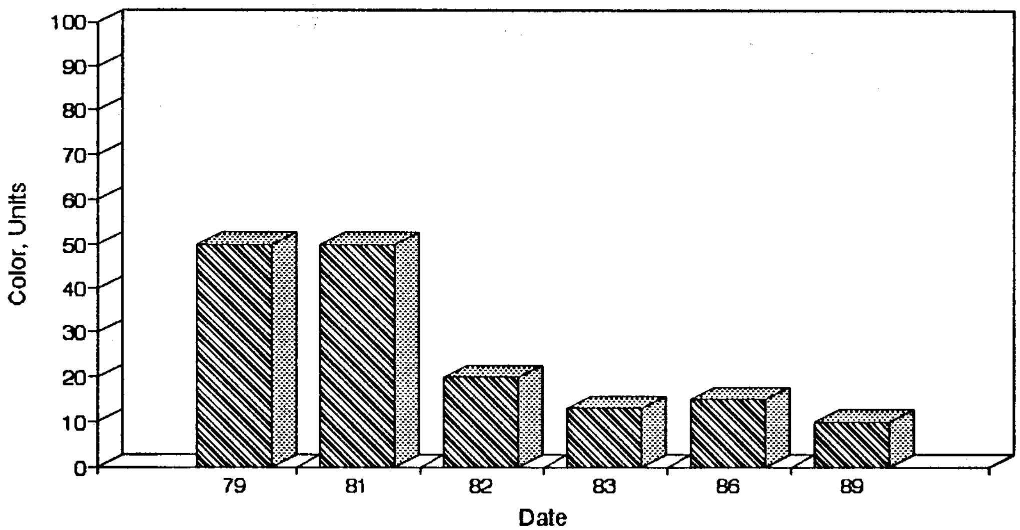

Figure E14. Graph of Color vs. Time for the Sugar Grove Site-Aug.

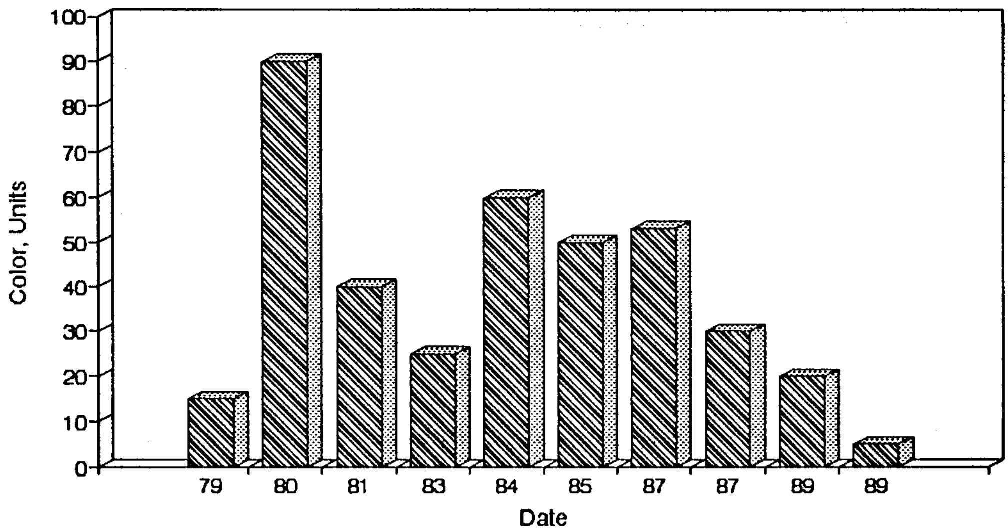

Figure E15. Graph of Color vs. Time for the Sugar Grove Site-Dec.

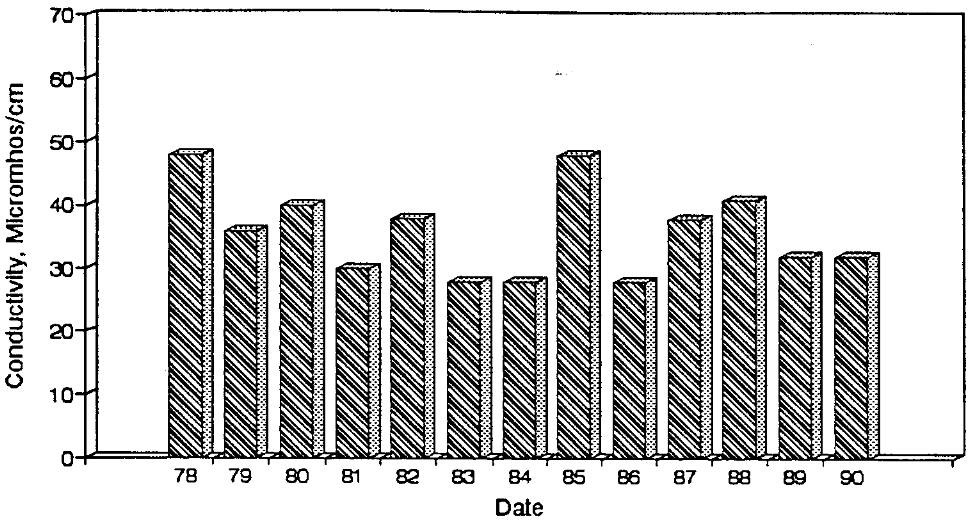

Figure E16. Graph of Conductivity vs. Time for the Sugar Grove Site-May.

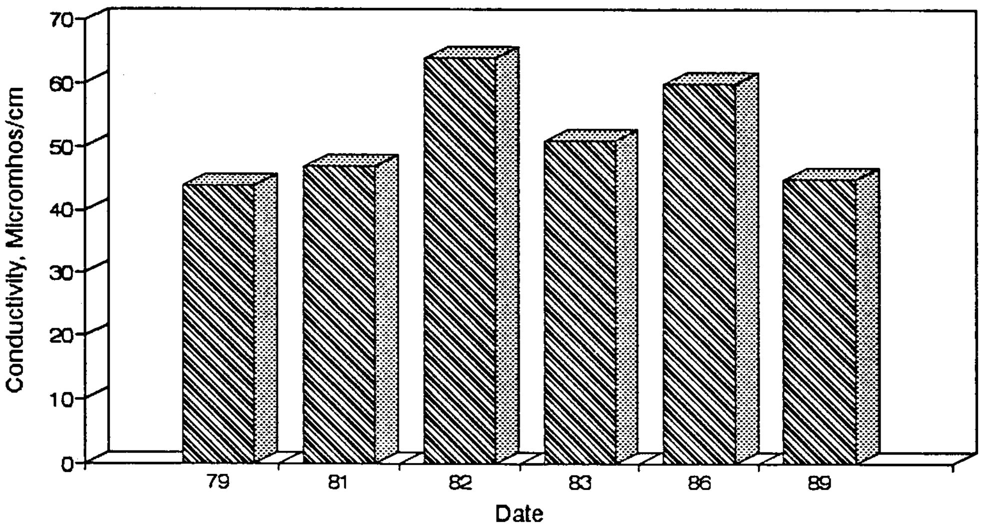

Figure E17. Graph of Conductivity vs. Time for the Sugar Grove Site-Aug.

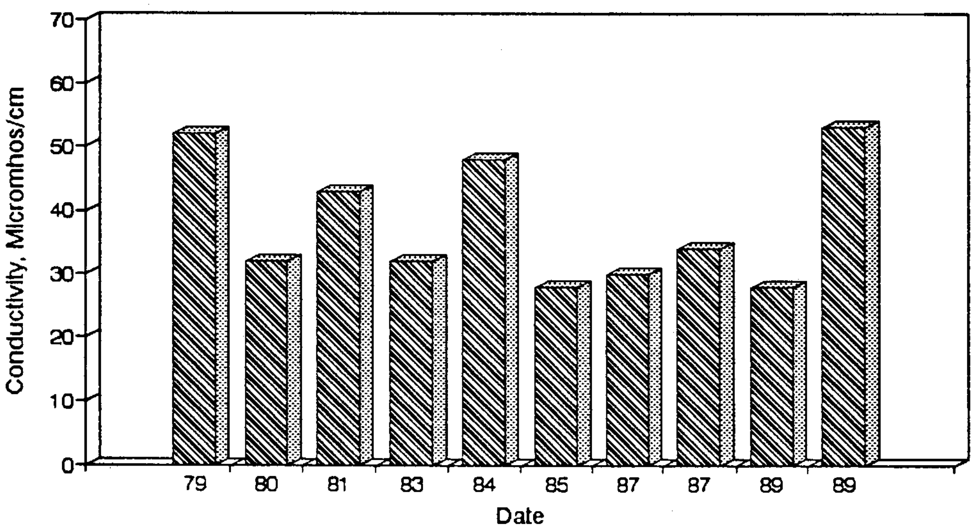

Figure E18. Graph of Conductivity vs. Time for the Sugar Grove Site-Dec.

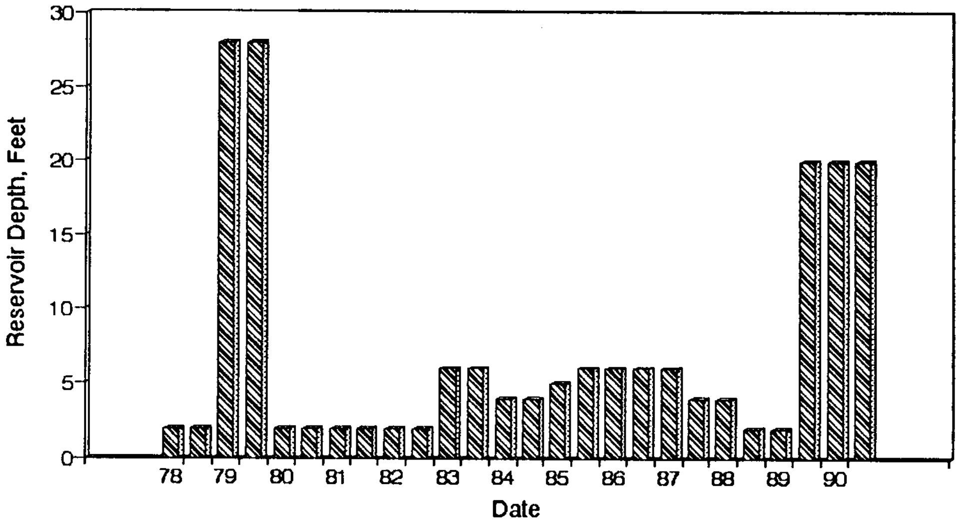

Figure E19. Graph of Reservoir Depth vs. Time for the Sugar Grove Site-May.

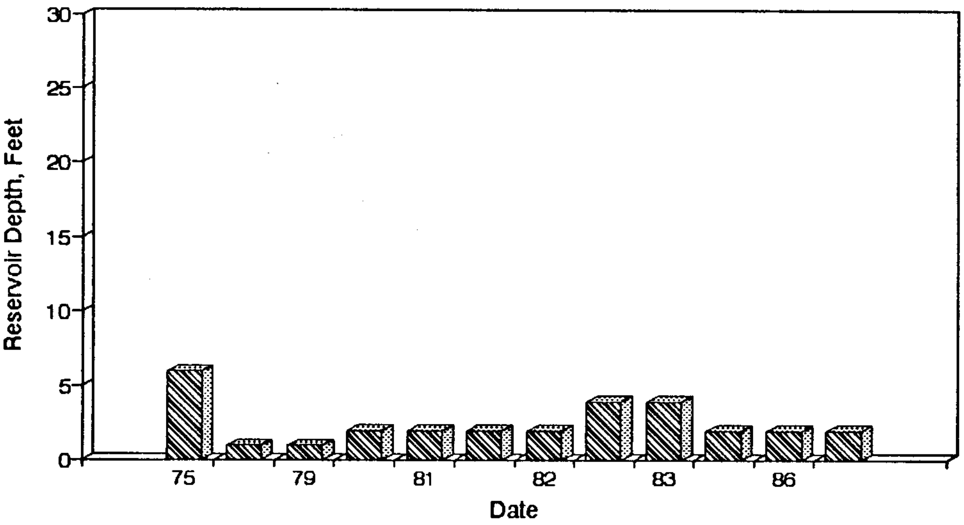

Figure E20. Graph of Reservoir Depth vs. Time for the Sugar Grove Site-Aug.

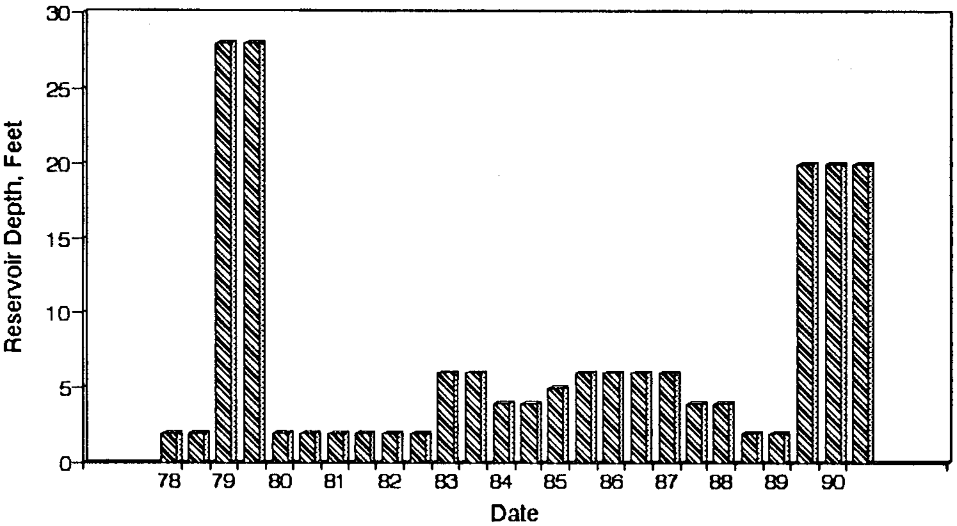

Figure E21. Graph of Reservoir Depth vs. Time for the Sugar Grove Site-Dec.

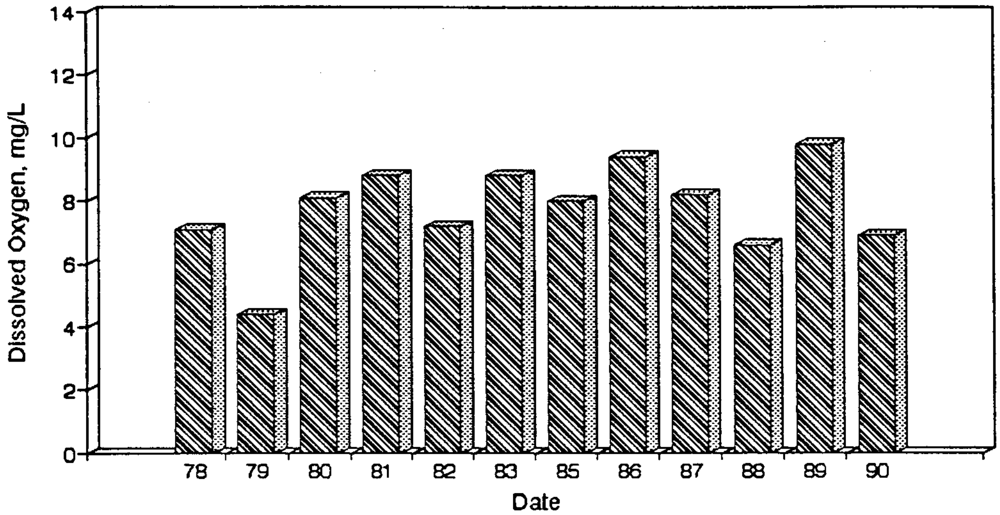

Figure E22. Graph of Dissolved Oxygen vs. Time for the Sugar Grove Site-May.

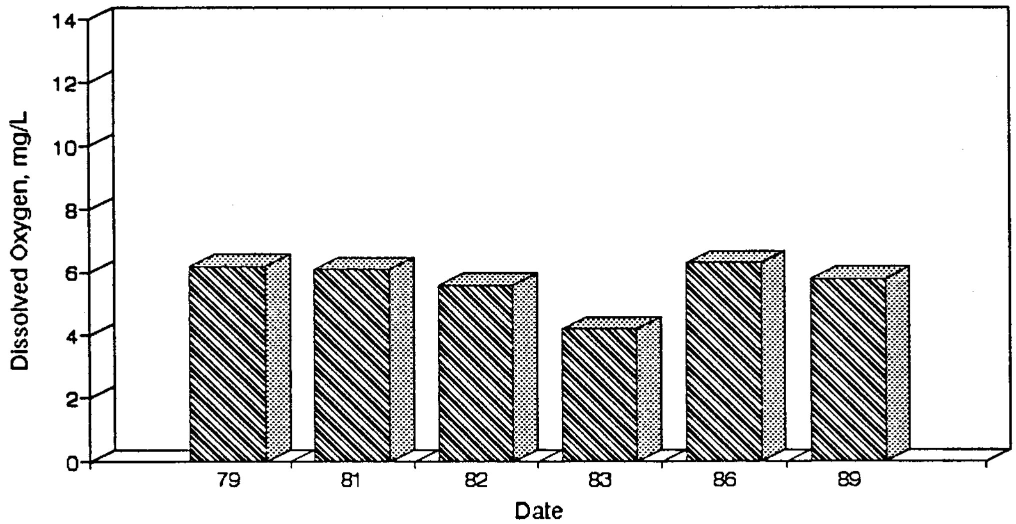

Figure E23. Graph of Dissolved Oxygen vs. Time for the Sugar Grove Site-Aug.

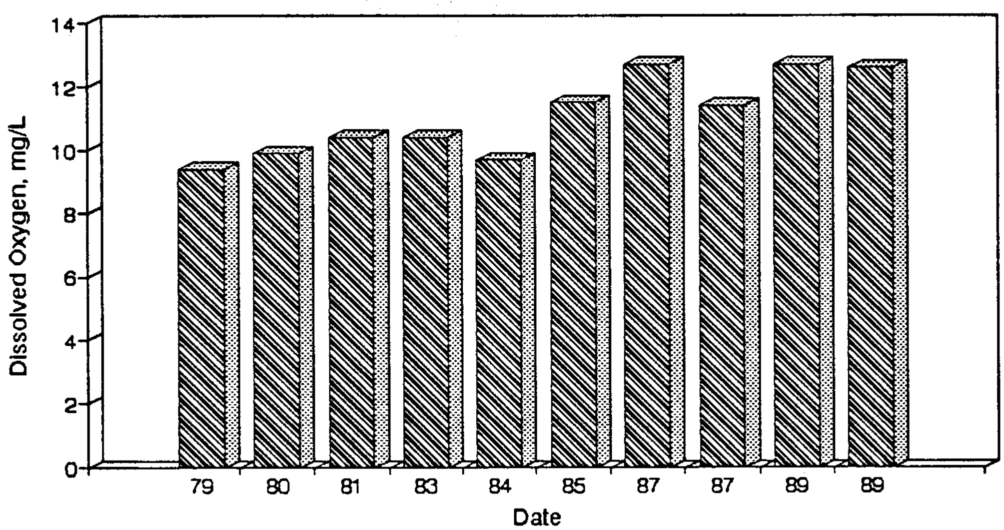

Figure E24. Graph of Dissolved Oxygen vs. Time for the Sugar Grove Site-Dec.

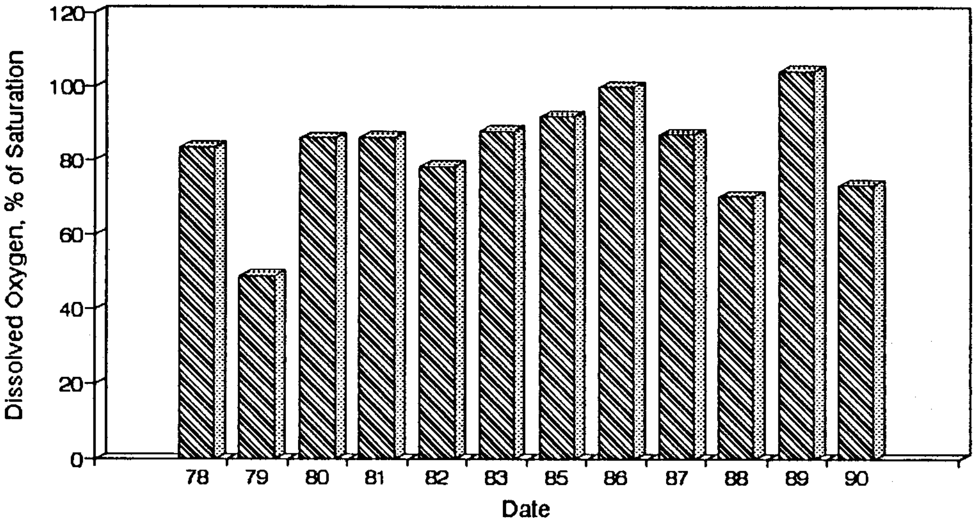

Figure E25. Graph of Dissolved Oxygen vs. Time for the Sugar Grove Site-May.

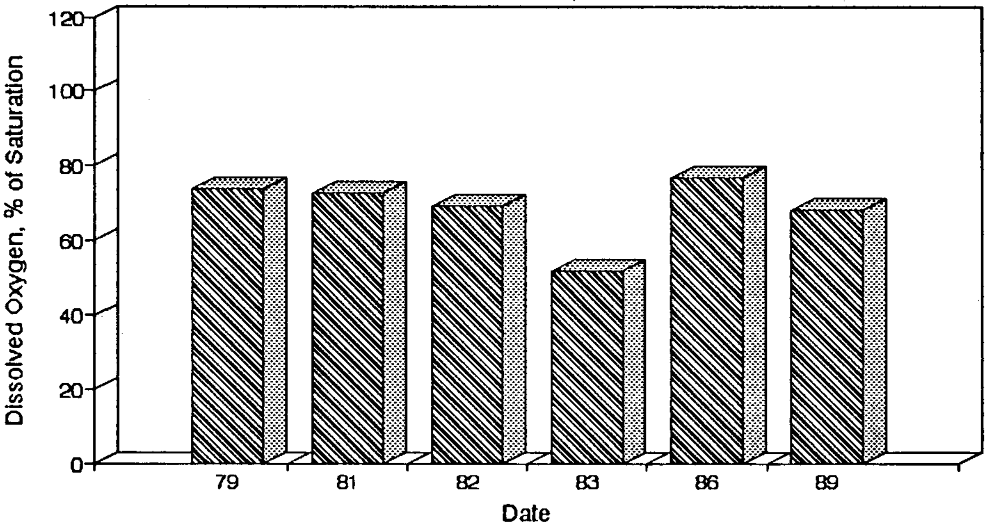

Figure E26. Graph of Dissolved Oxygen vs. Time for the Sugar Grove Site-Aug.

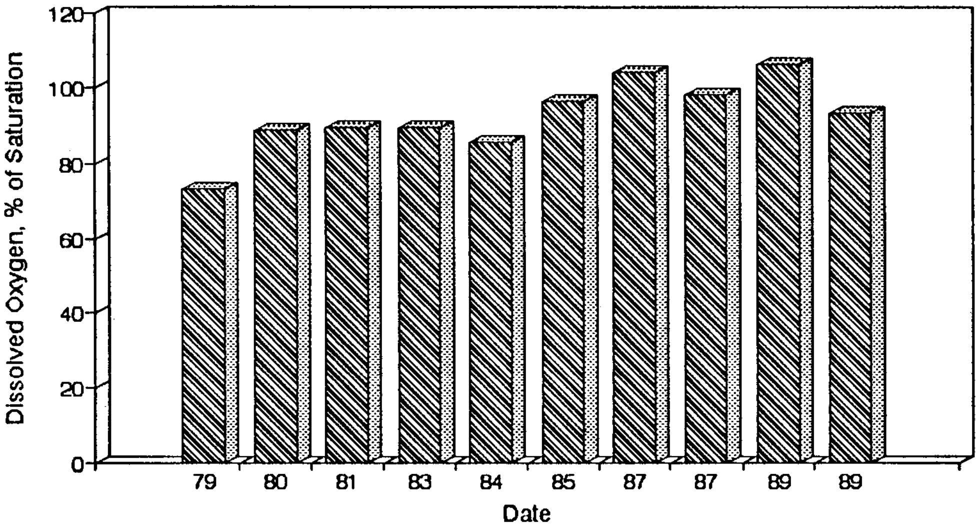

Figure E27. Graph of Dissolved Oxygen vs. Time for the Sugar Grove Site-Dec.

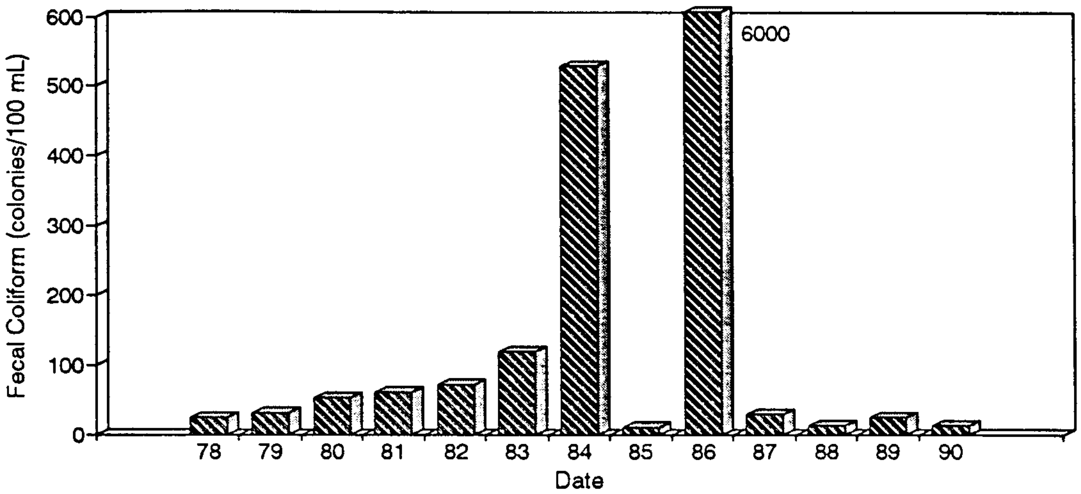

Figure E28. Graph of Fecal Coliform vs. Time for the Sugar Grove Site-May.

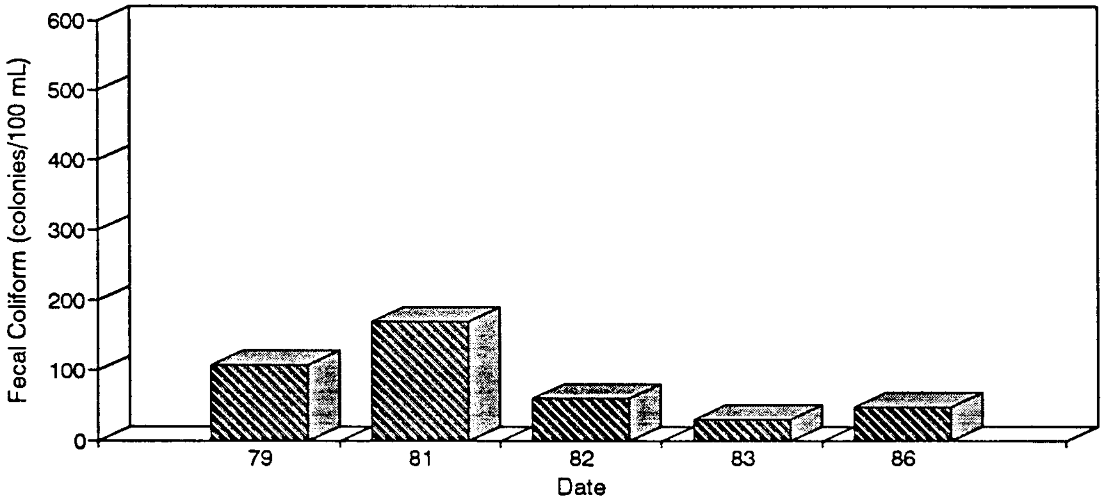

Figure E29. Graph of Fecal Coliform vs. Time for the Sugar Grove Site-Aug.

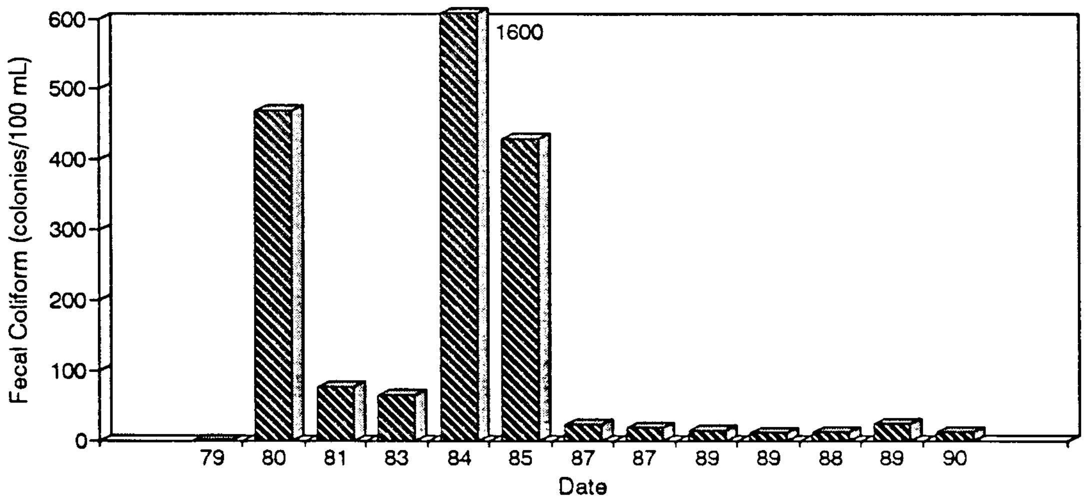

Figure E30. Graph of Fecal Coliform vs. Time for the Sugar Grove Site-Dec.

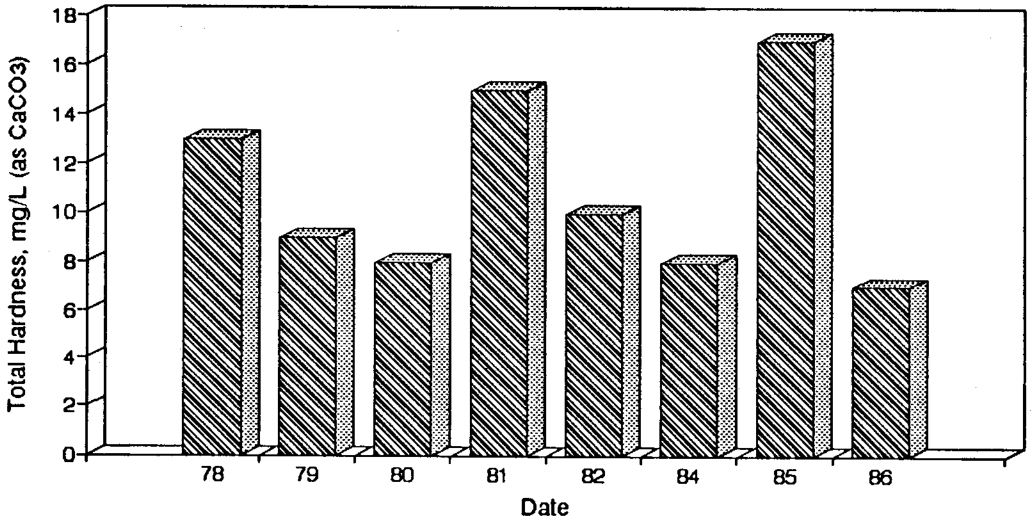

Figure E31. Graph of Total Hardness vs. Time for the Sugar Grove Site-May.

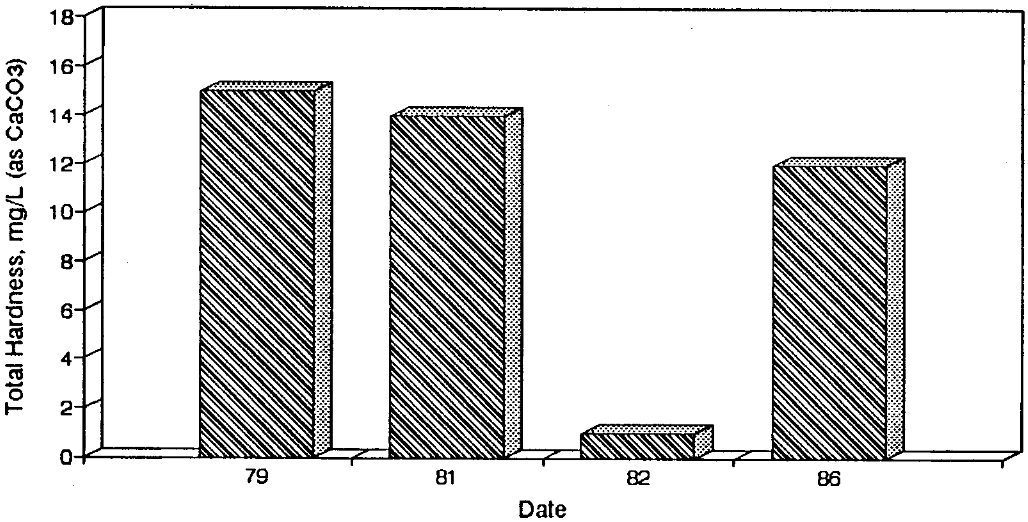

Figure E32. Graph of Total Hardness vs. Time for the Sugar Grove Site-Aug.

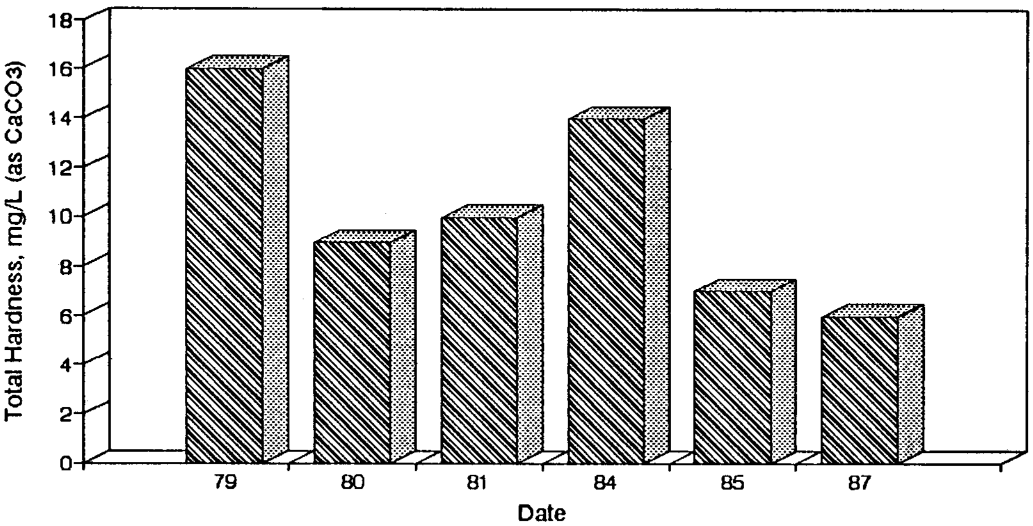

Figure E33. Graph of Total Hardness vs. Time for the Sugar Grove Site-Dec.

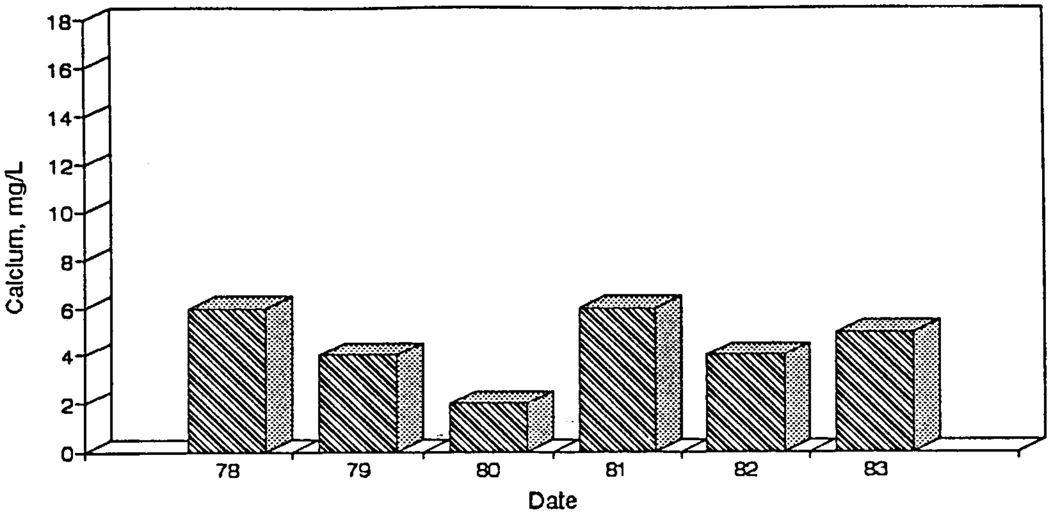

Figure E34. Graph of Calcium vs. Time for the Sugar Grove Site-May.

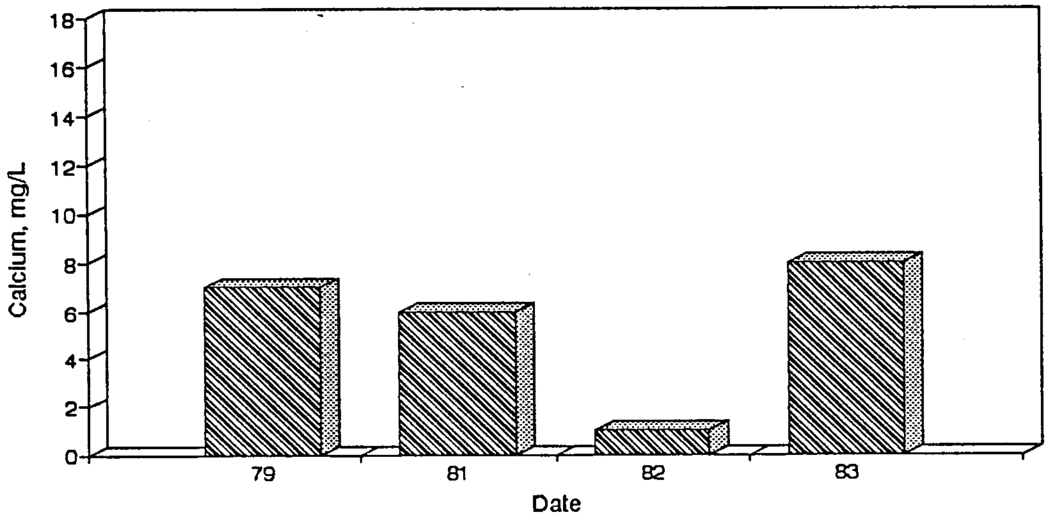

Figure E35. Graph of Calcium vs. Time for the Sugar Grove Site-Aug.

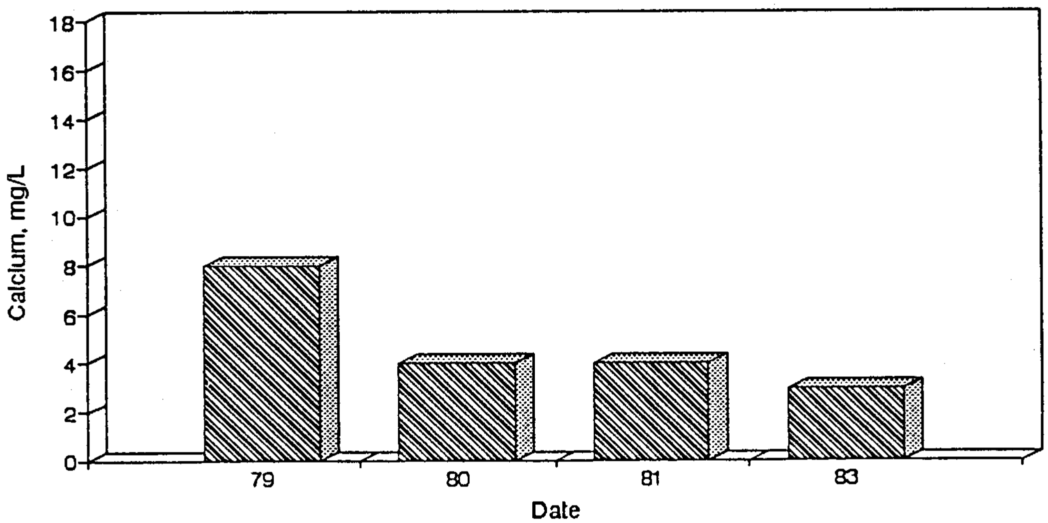

Figure E36. Graph of Calcium vs. Time for the Sugar Grove Site-Dec.

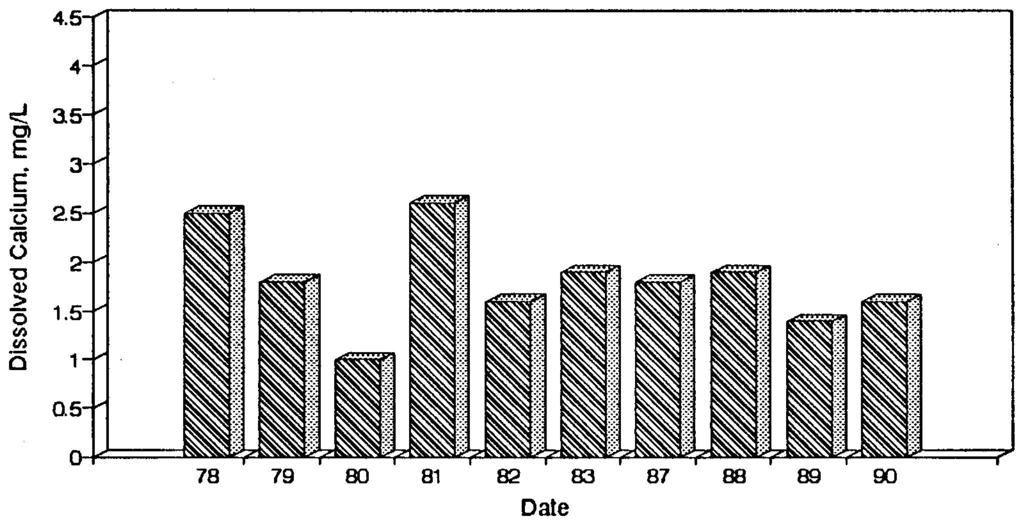

Figure E37. Graph of Dissolved Calcium vs. Time for the Sugar Grove Site-May.

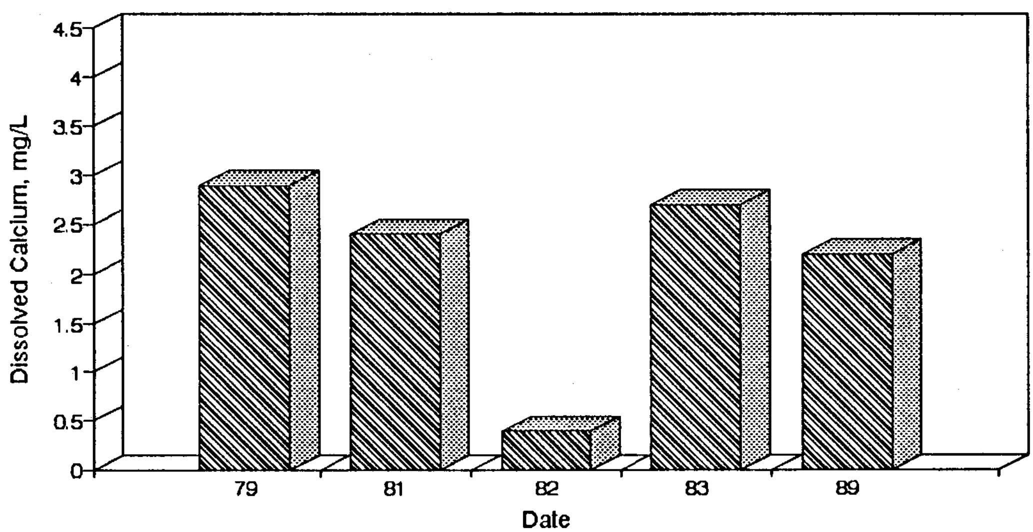

Figure E38. Graph of Dissolved Calcium vs. Time for the Sugar Grove Site-Aug.

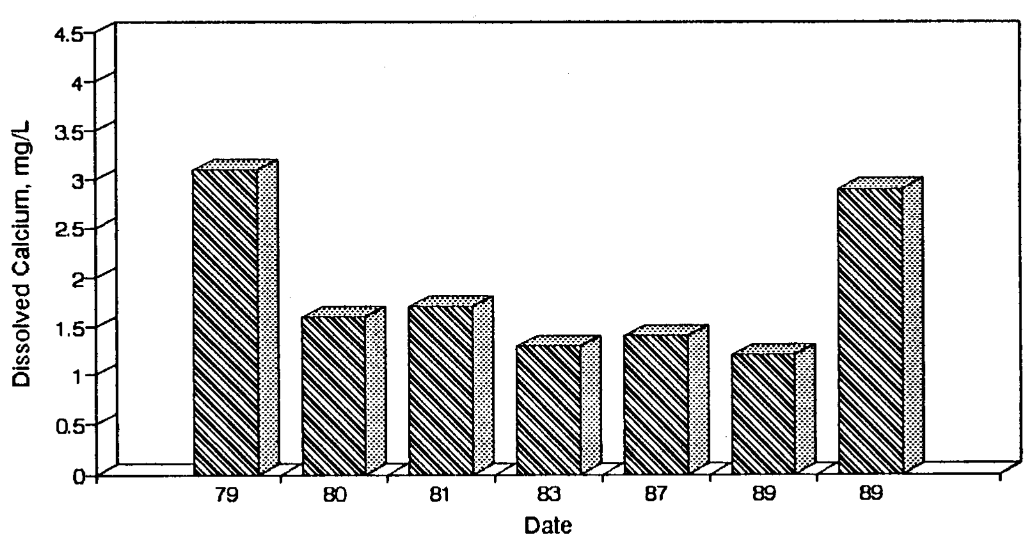

Figure E39. Graph of Dissolved Calcium vs. Time for the Sugar Grove Site-Dec.

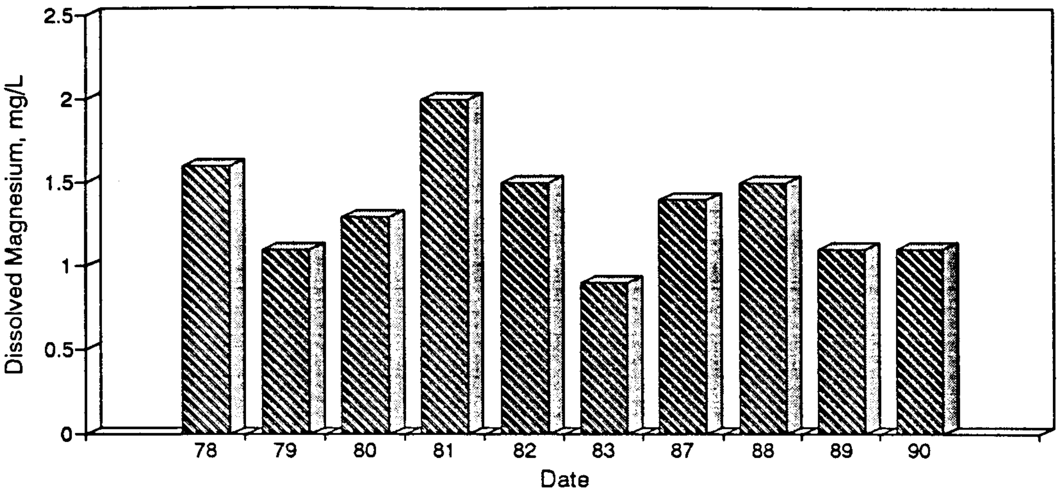

Figure E40. Graph of Dissolved Magnesium vs. Time for the Sugar Grove Site-May.

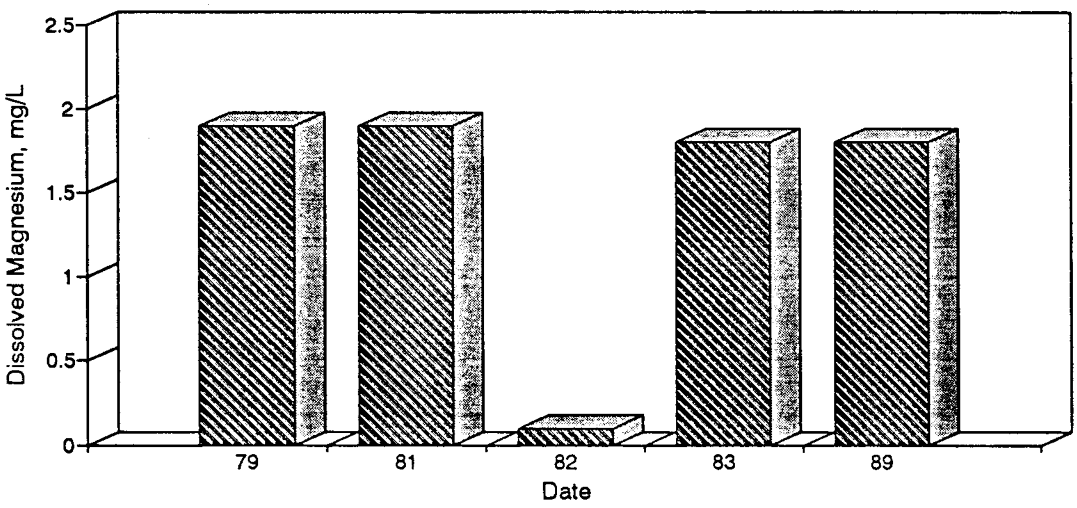

Figure E41. Graph of Dissolved Magnesium vs. Time for the Sugar Grove Site-Aug.

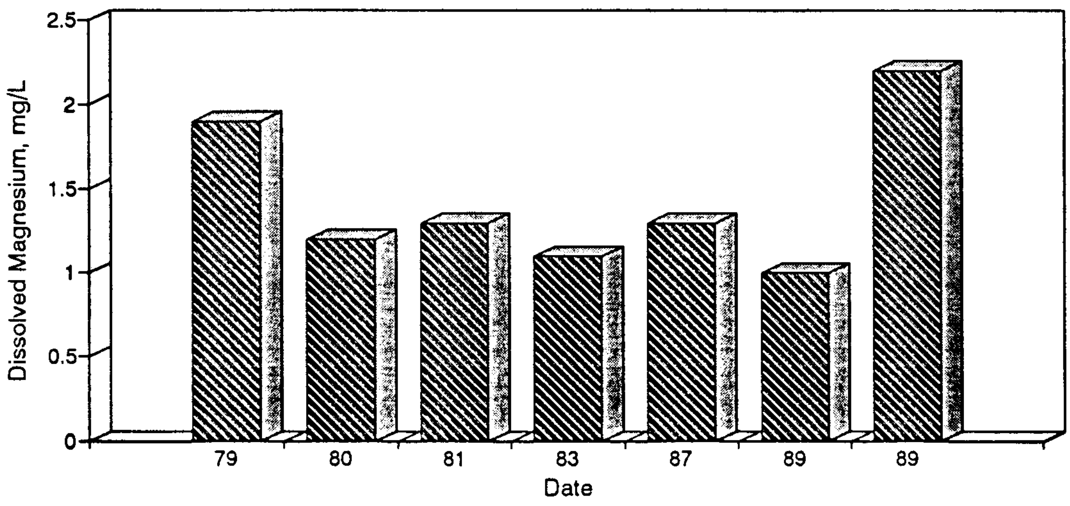

Figure E42. Graph of Dissolved Magnesium vs. Time for the Sugar Grove Site-Dec.

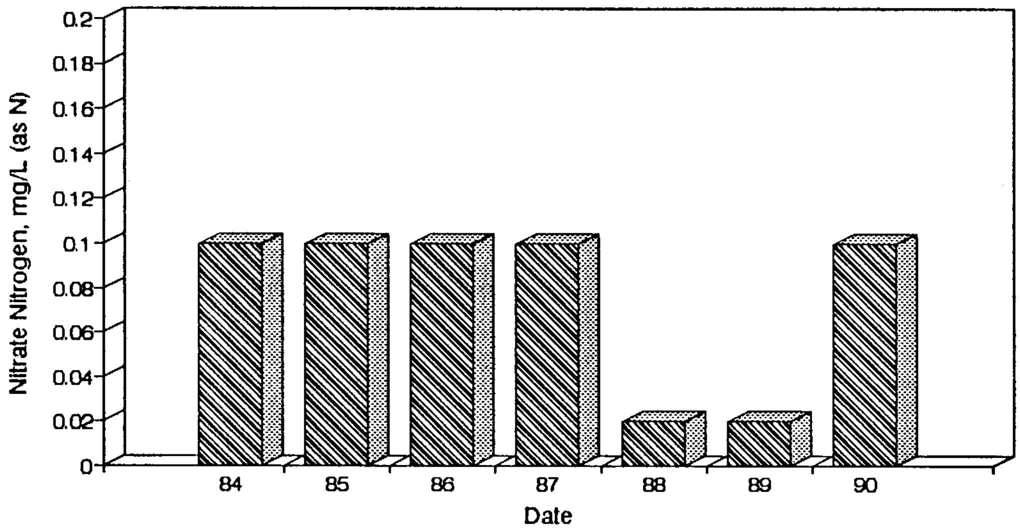

Figure E43. Graph of Nitrate Nitrogen vs. Time for the Sugar Grove Site-May.

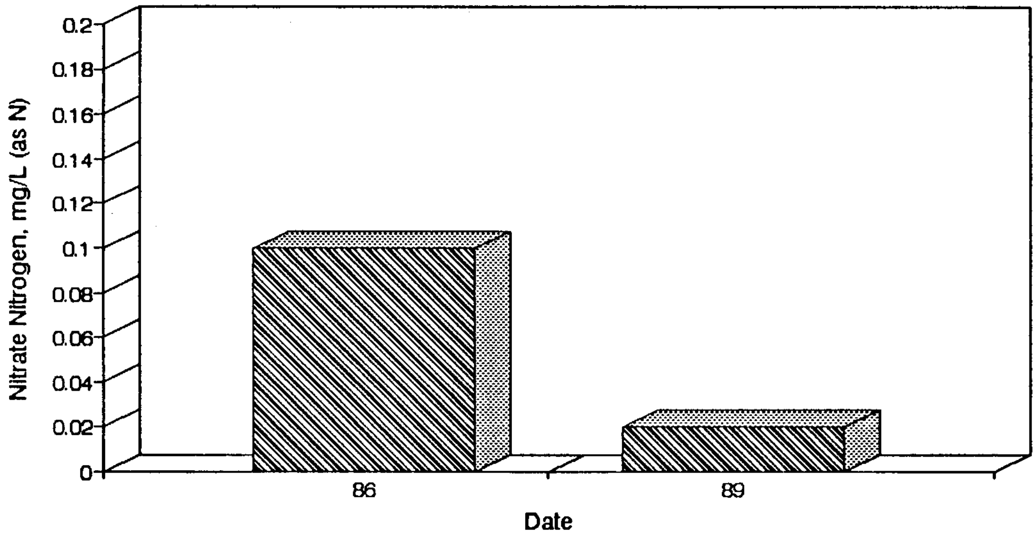

Figure E44. Graph of Nitrate Nitrogen vs. Time for the Sugar Grove Site-Aug.

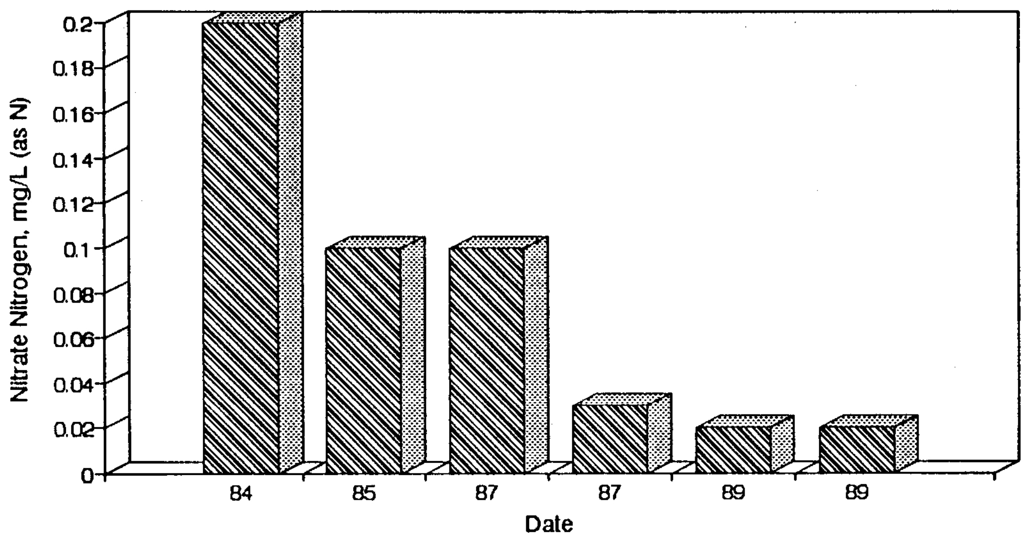

Figure E45. Graph of Nitrate Nitrogen vs. Time for the Sugar Grove Site-Dec.

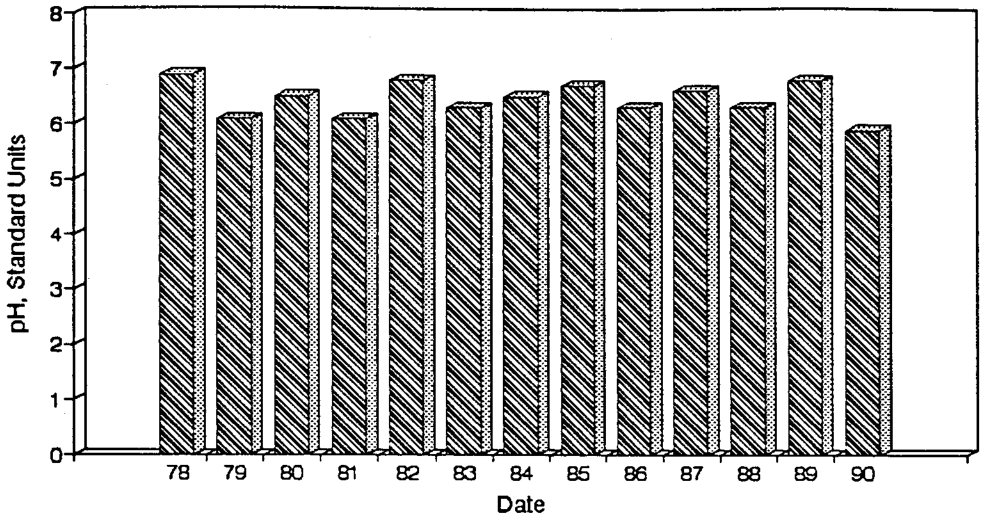

Figure E46. Graph of pH vs. Time for the Sugar Grove Site-May.

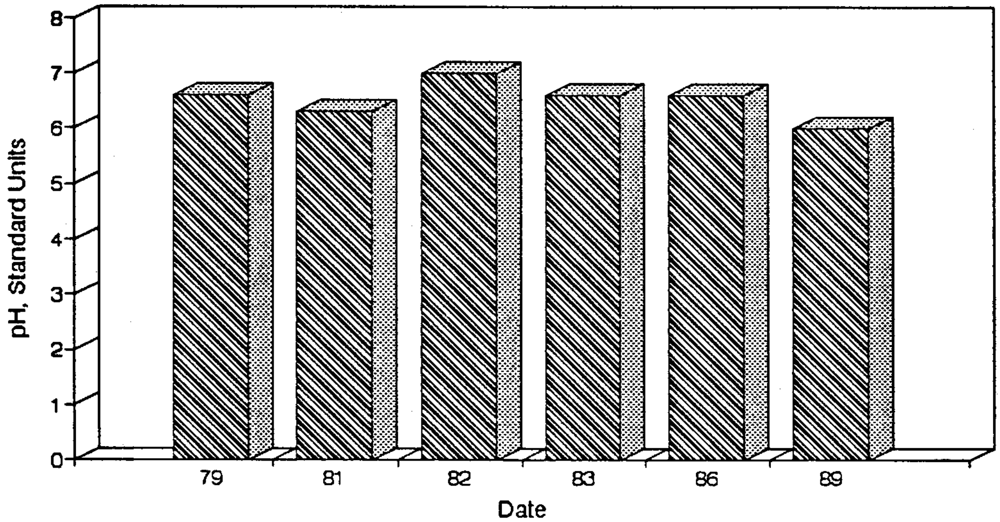

Figure E47. Graph of pH vs. Time for the Sugar Grove Site-Aug.

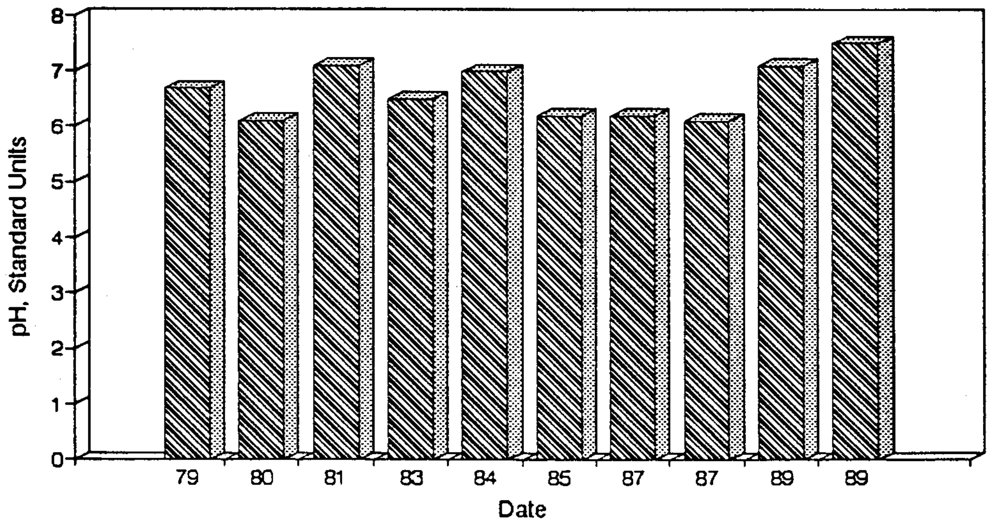

Figure E48. Graph of pH vs. Time for the Sugar Grove Site-Dec.

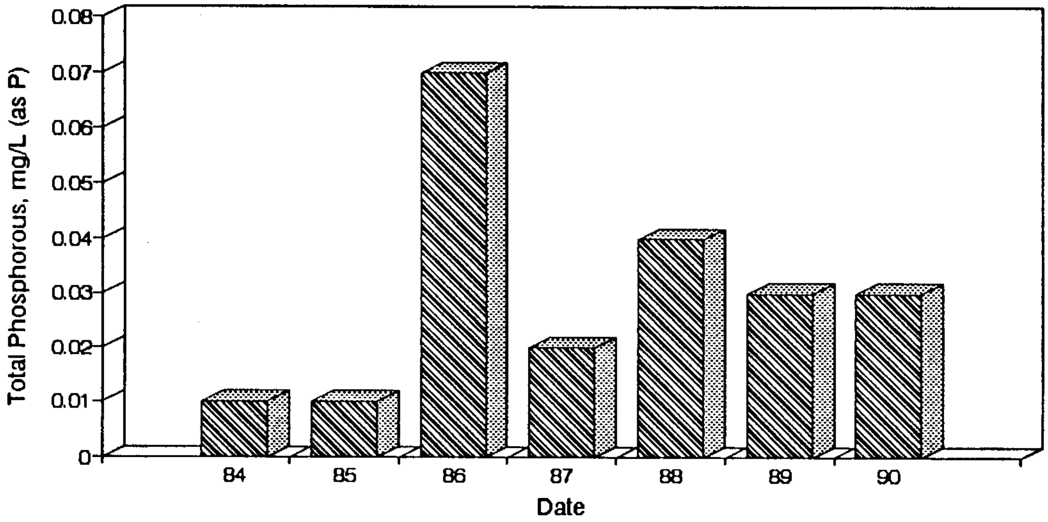

Figure E49. Graph of Total Phosphorous vs. Time for the Sugar Grove Site-May.

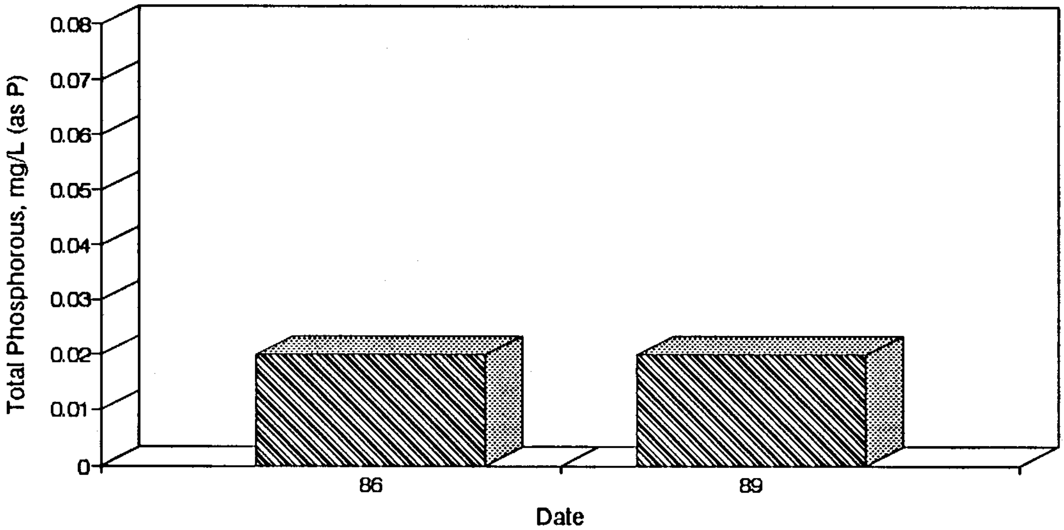

Figure E50. Graph of Total Phosphorous vs. Time for the Sugar Grove Site-Aug.

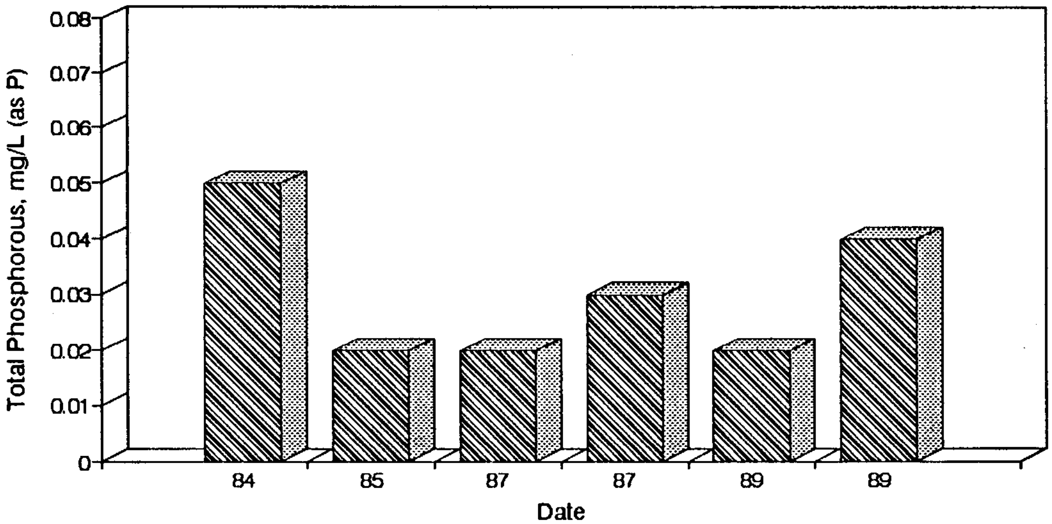

Figure E51. Graph of Total Phosphorous vs. Time for the Sugar Grove Site-Dec.

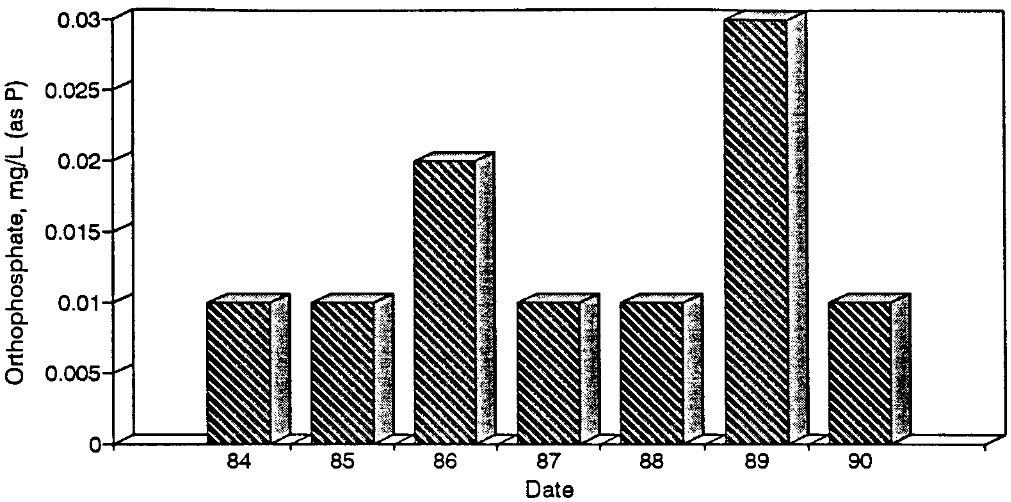

Figure E52. Graph of Orthophosphate vs. Time for the Sugar Grove Site-May.

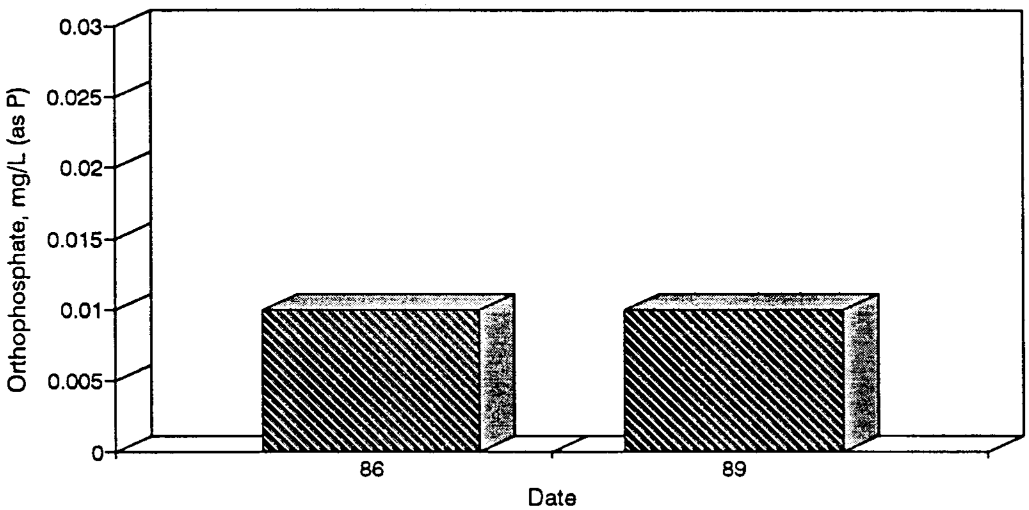

Figure E53. Graph of Orthophosphate vs. Time for the Sugar Grove Site-Aug.

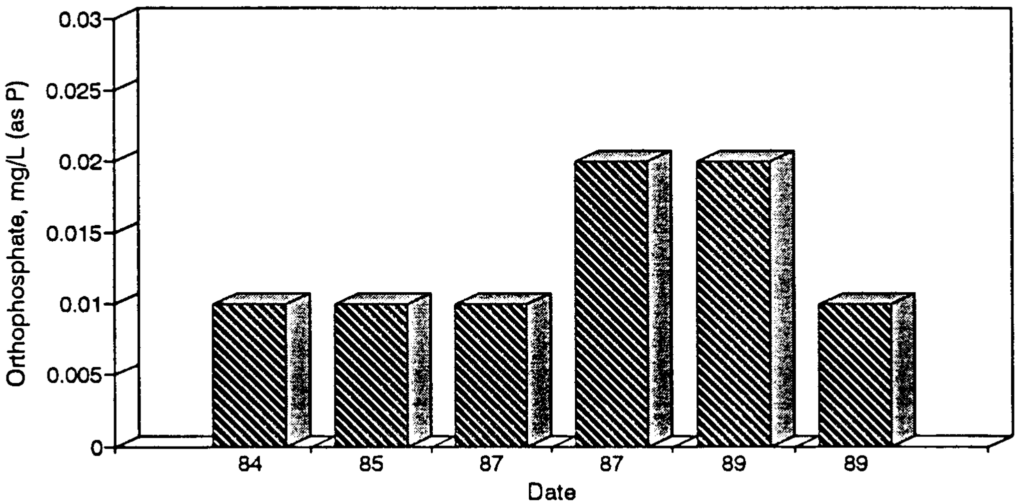

Figure E54. Graph of Orthophosphate vs. Time for the Sugar Grove Site-Dec.

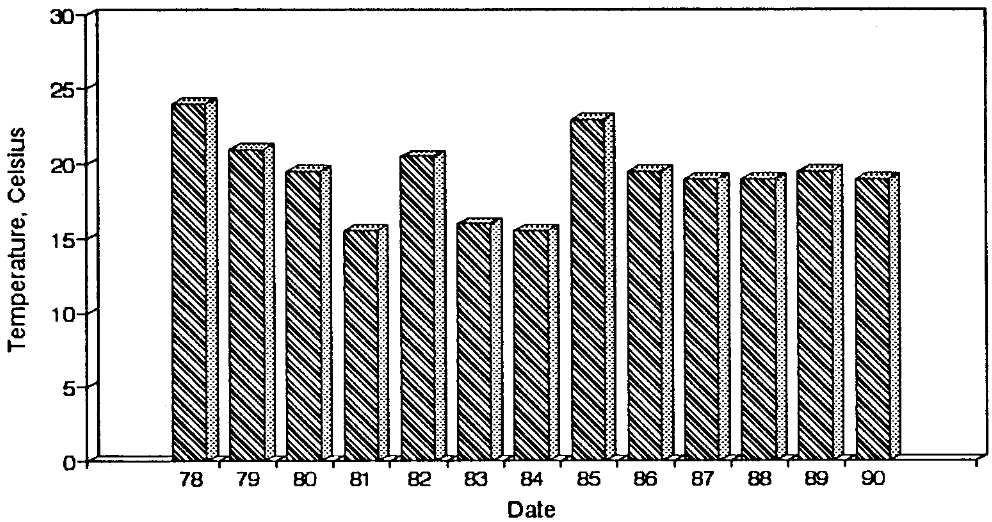

Figure E55. Graph of Temperature vs. Time for the Sugar Grove Site-May.

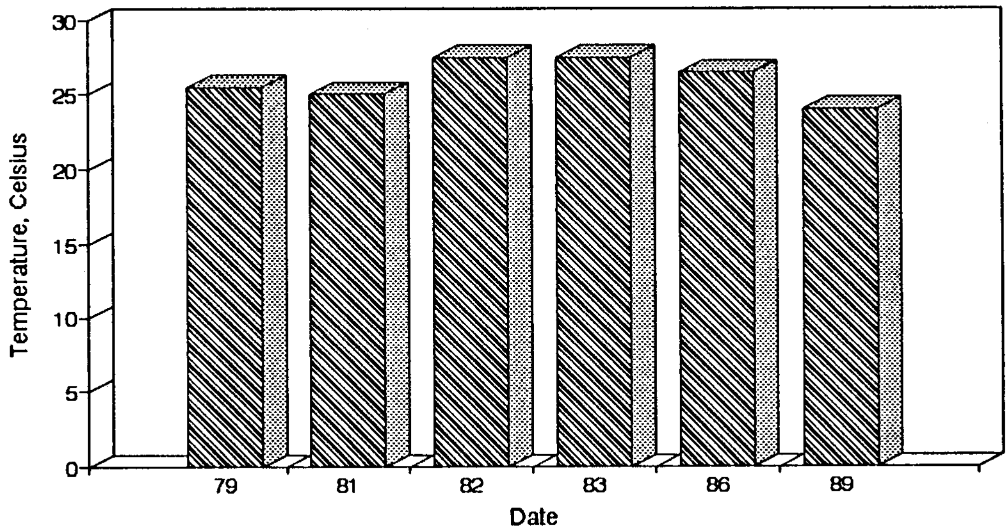

Figure E56. Graph of Temperature vs. Time for the Sugar Grove Site-Aug.

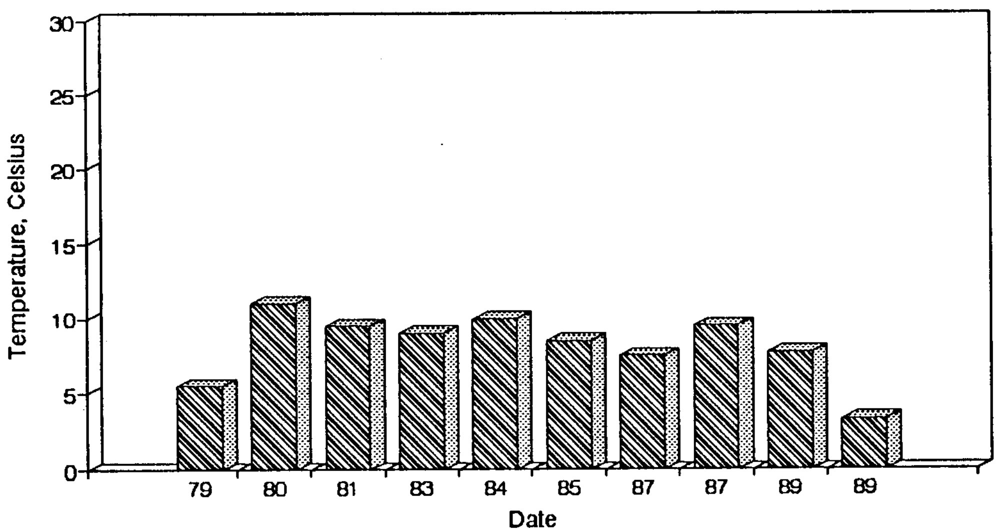

Figure E57. Graph of Temperature vs. Time for the Sugar Grove Site-Dec.

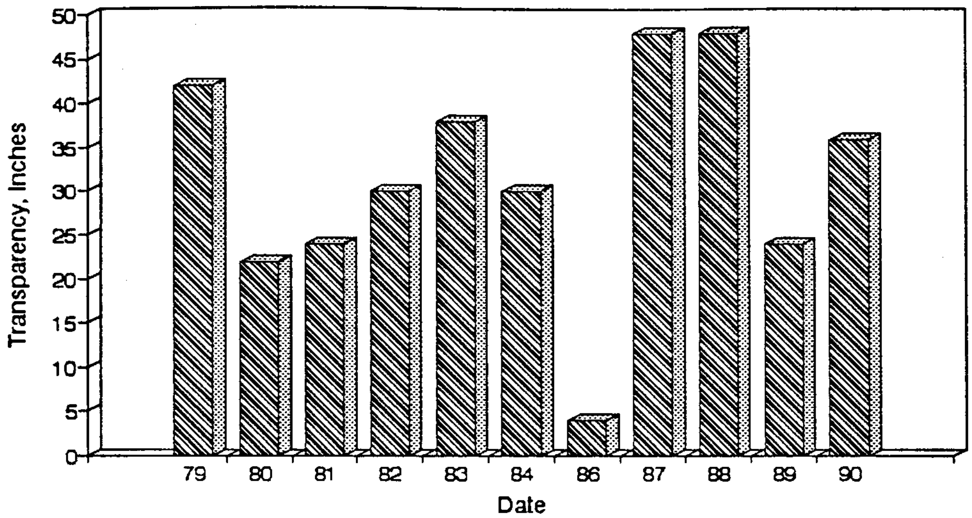

Figure E58. Graph of Transparency vs. Time for the Sugar Grove Site-May.

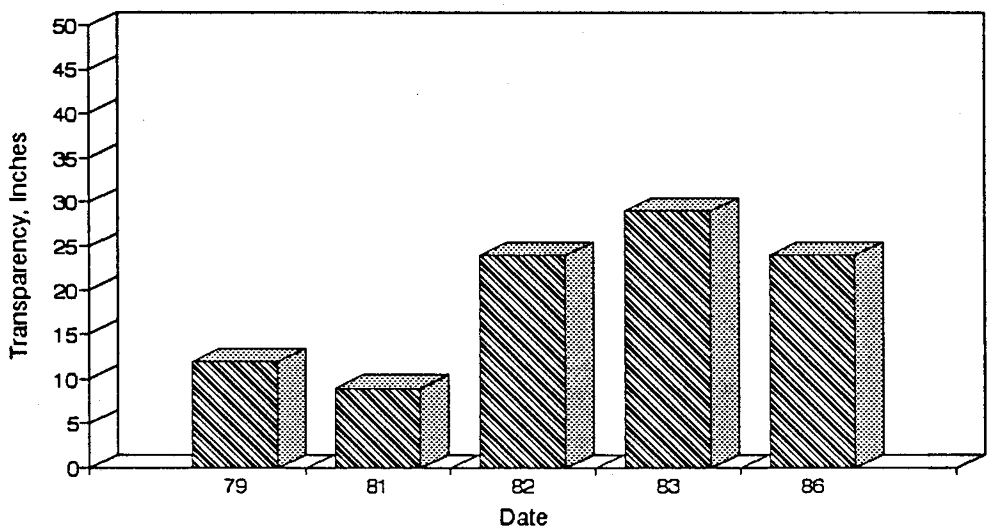

Figure E59. Graph of Transparency vs. Time for the Sugar Grove Site-Aug.

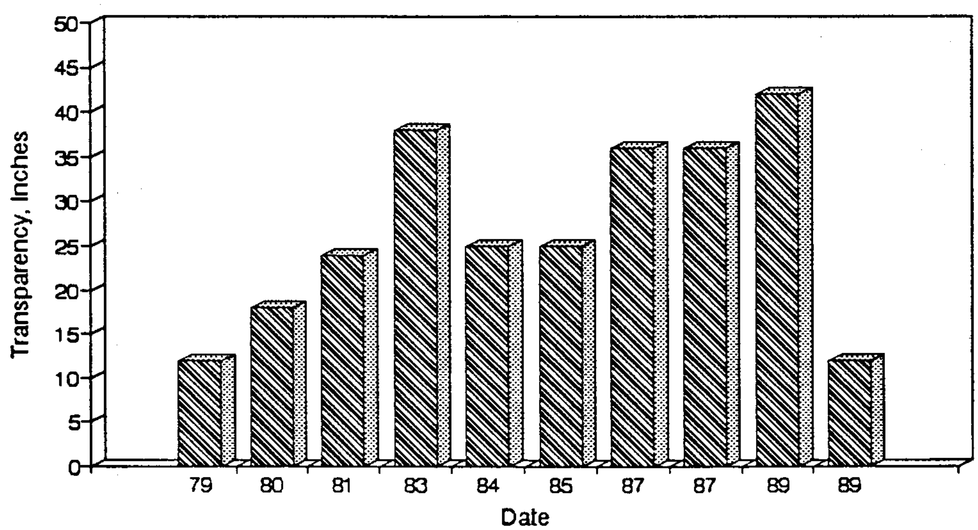

Figure E60. Graph of Transparency vs. Time for the Sugar Grove Site-Dec.

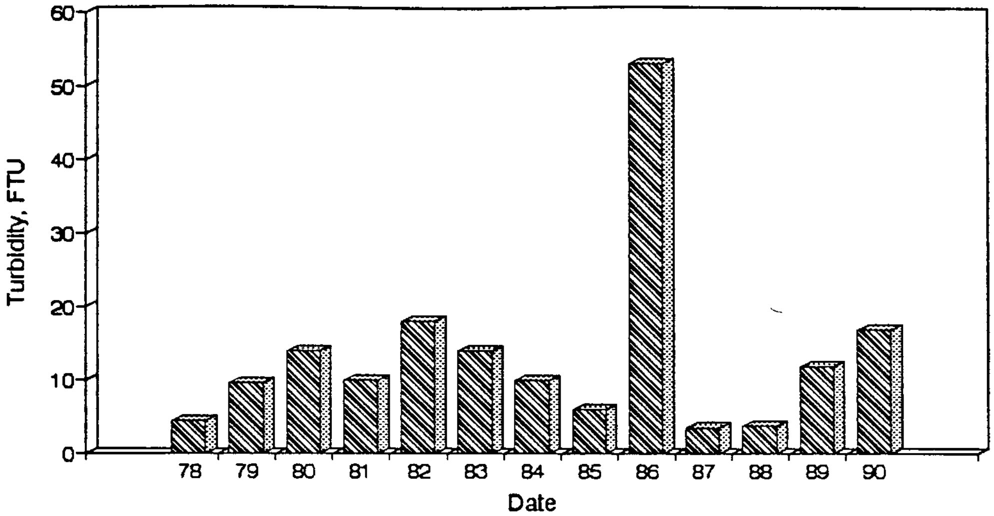

Figure E61. Graph of Turbidity vs. Time for the Sugar Grove Site-May.

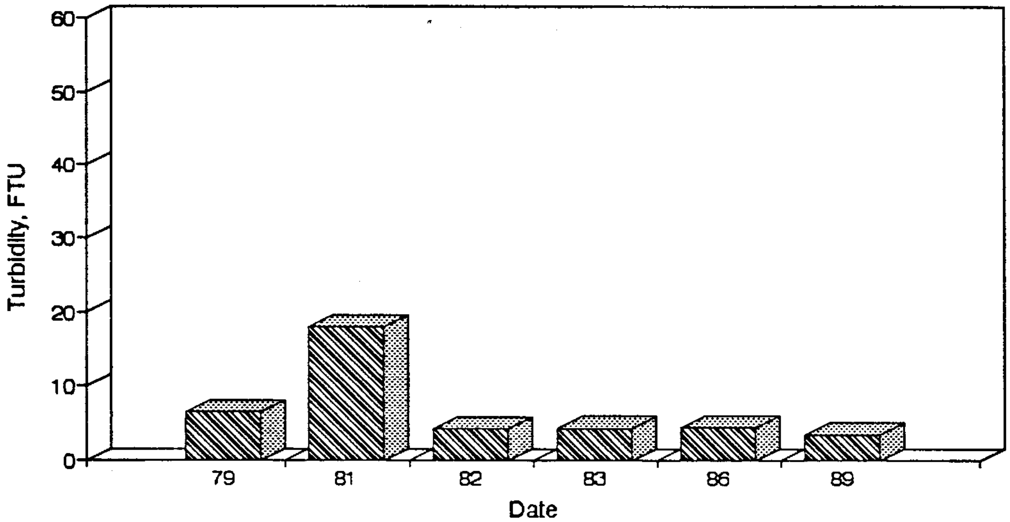

Figure E62. Graph of Turbidity vs. Time for the Sugar Grove Site-Aug.

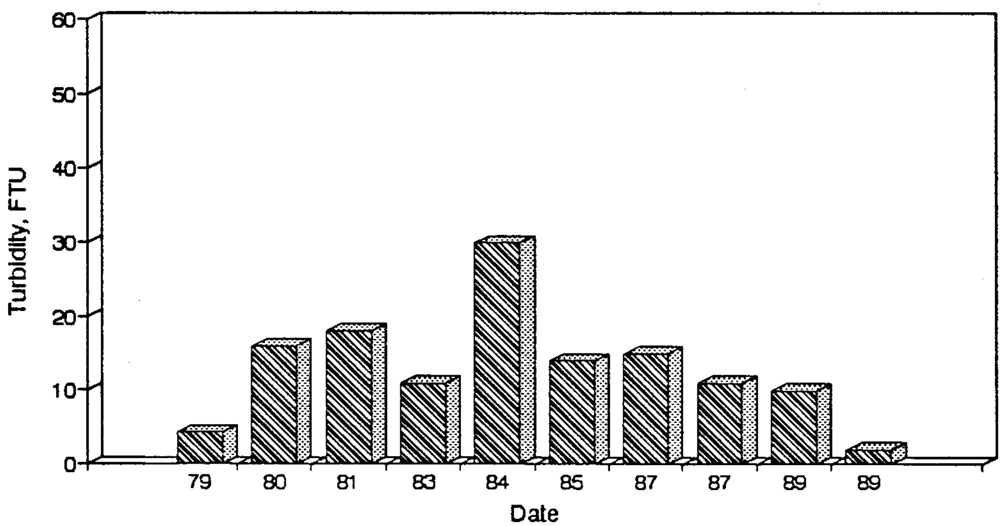

Figure E63. Graph of Turbidity vs. Time for the Sugar Grove Site-Dec.

APPENDIX F

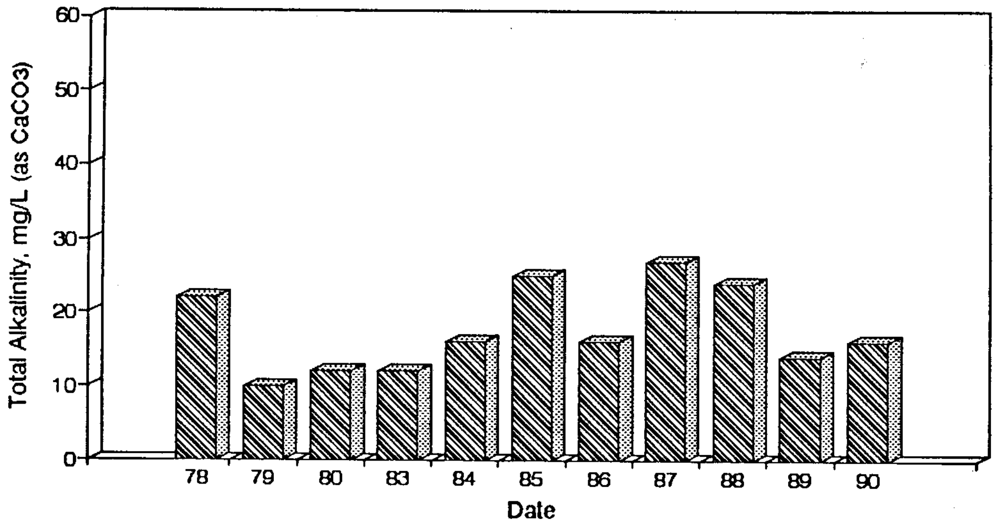

Figure F1. Graph of Total Alkalinity vs. Time for the Narrows Site-May.

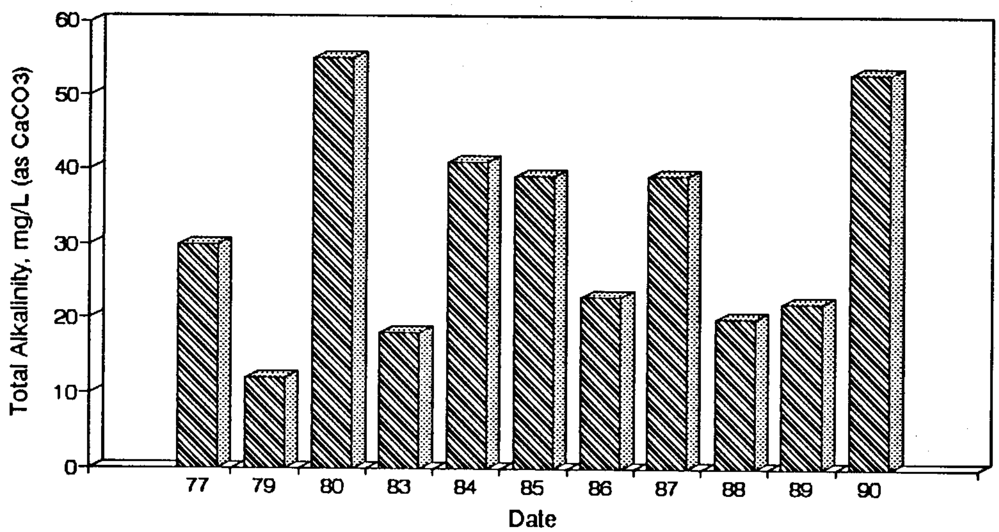

Figure F2. Graph of Total Alkalinity vs. Time for the Narrows Site-Aug.

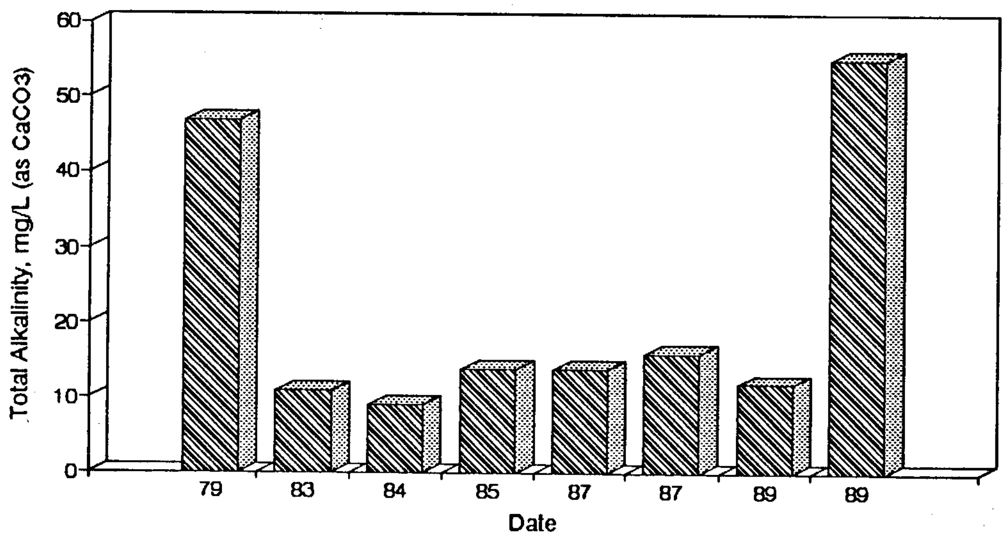

Figure F3. Graph of Total Alkalinity vs. Time for the Narrows Site-Dec.

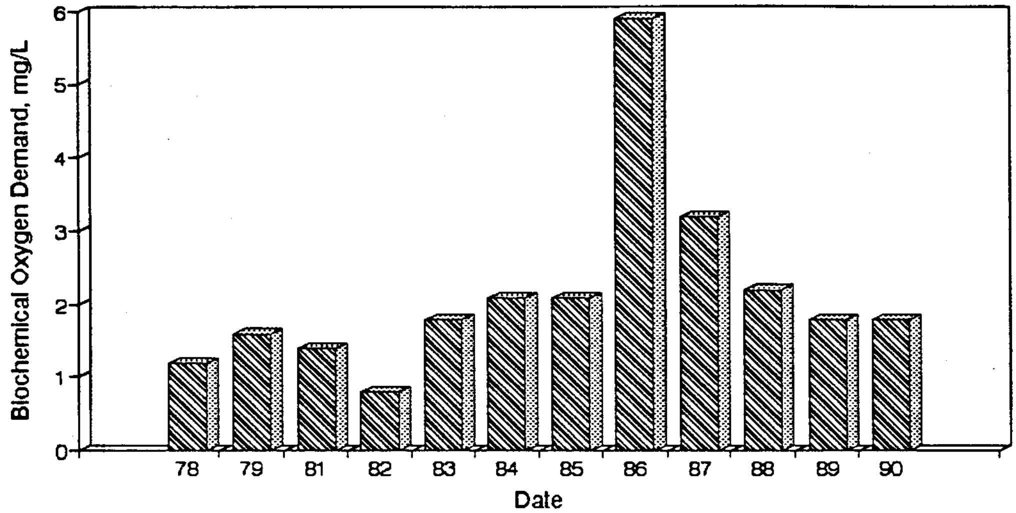

Figure F4. Graph of Biochemical Oxygen Demand vs. Time for the Narrows Site-May.

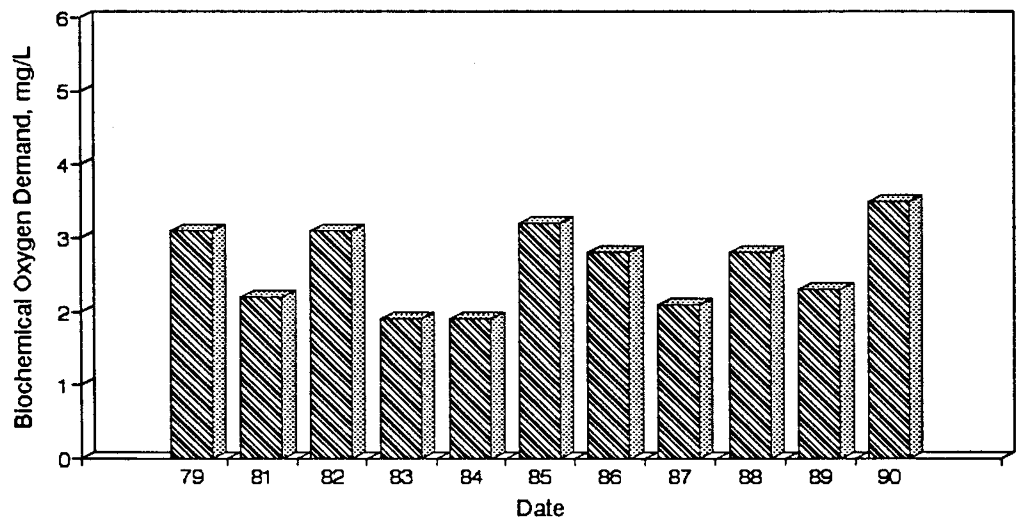

Figure F5. Graph of Biochemical Oxygen Demand vs. Time for the Narrows Site-Aug.

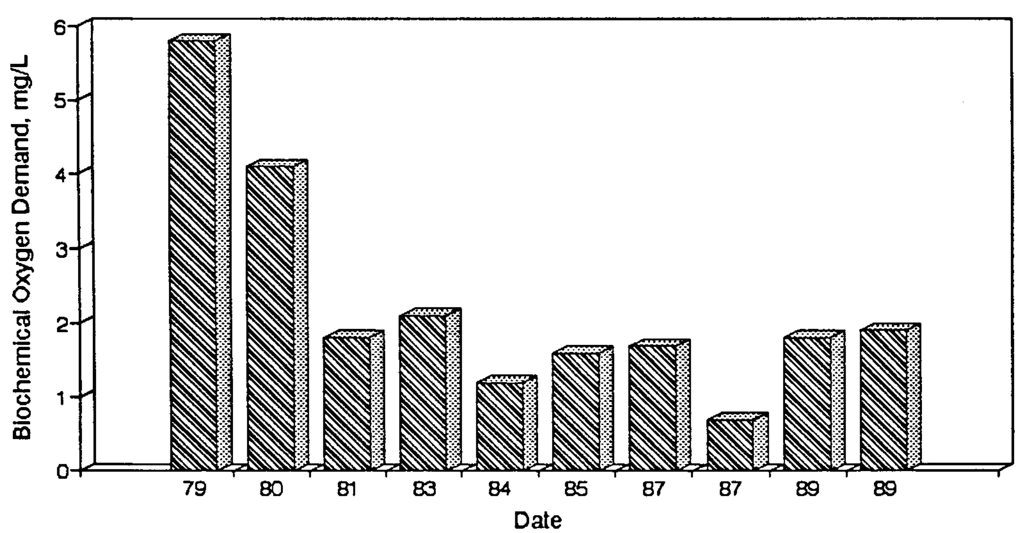

Figure F6. Graph of Biochemical Oxygen Demand vs. Time for the Narrows Site-Dec.

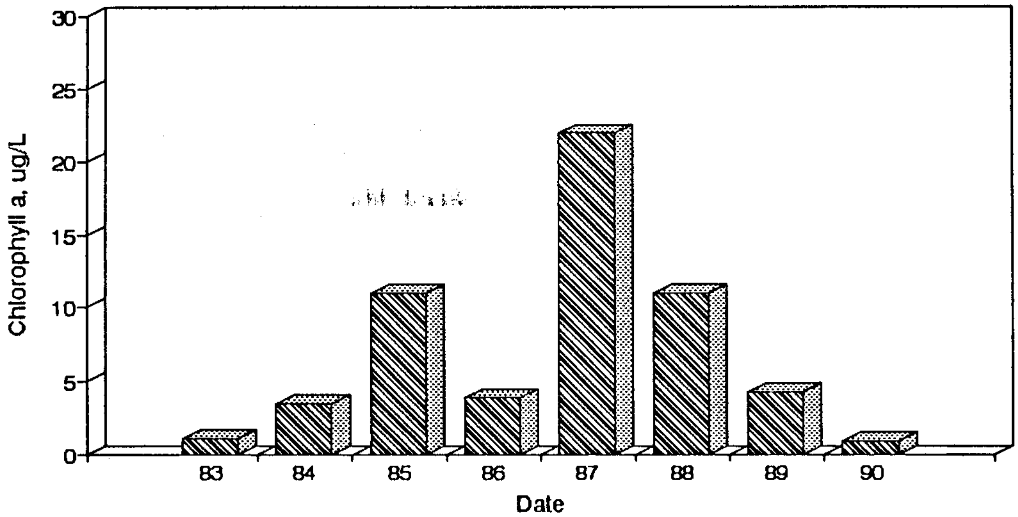

Figure F7. Graph of Chlorophyll a vs. Time for the Narrows Site-May.

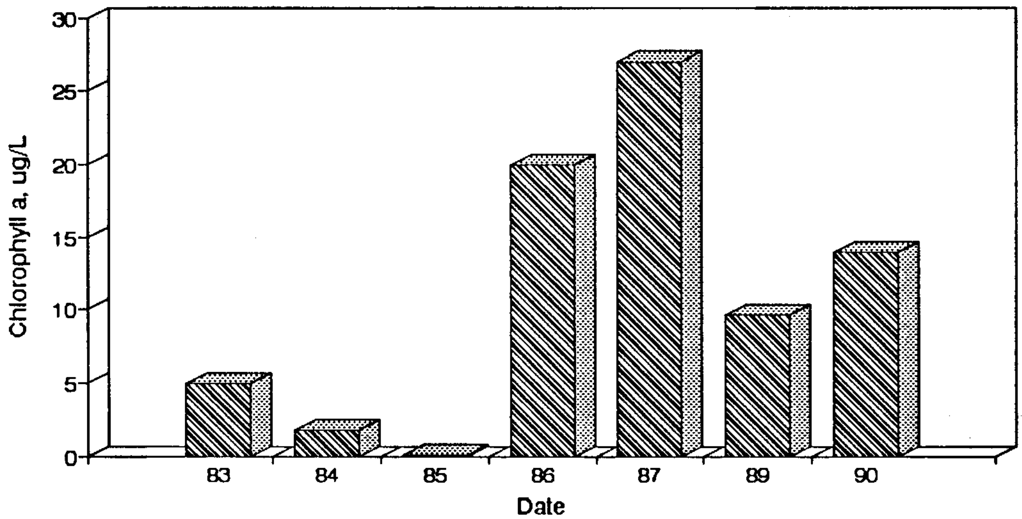

Figure F8. Graph of Chlorophyll a vs. Time for the Narrows Site-Aug.

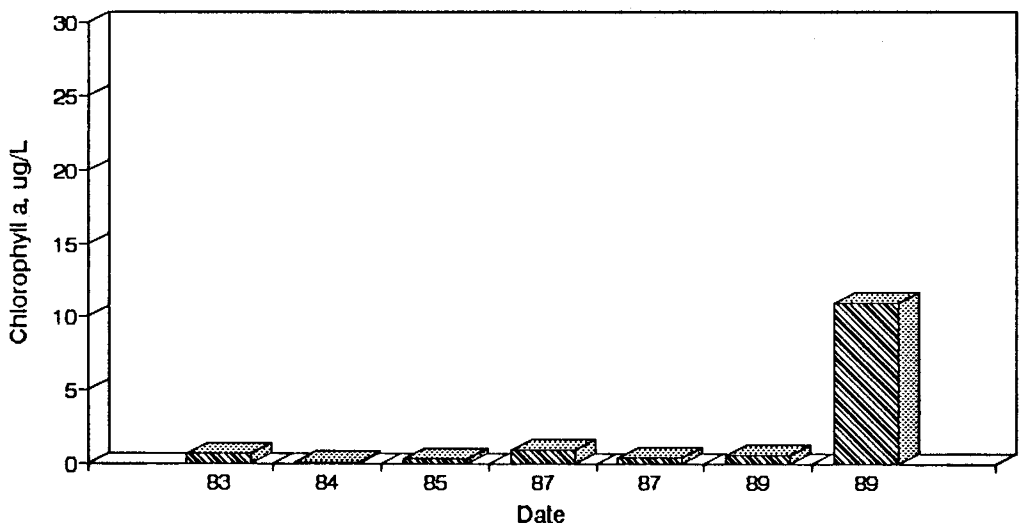

Figure F9. Graph of Chlorophyll a vs. Time for the Narrows Site-Dec.

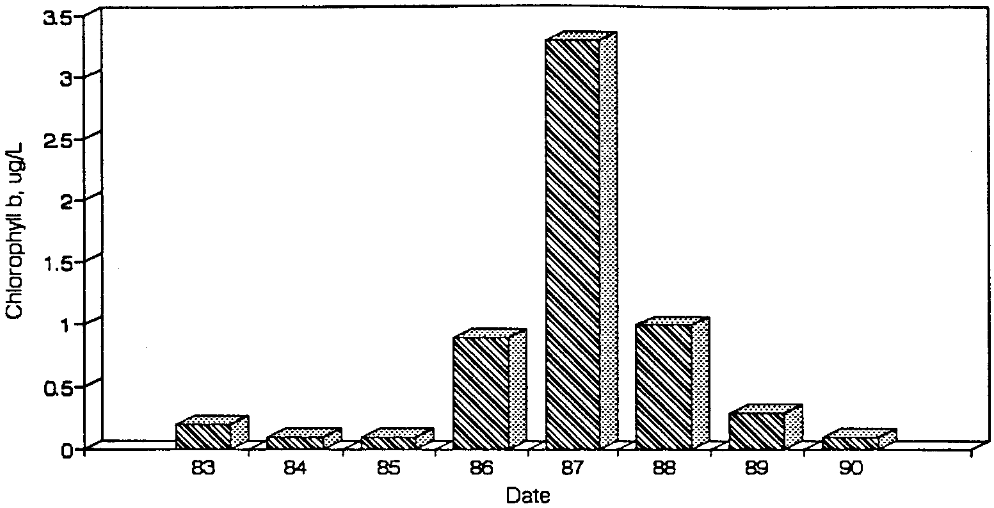

Figure F10. Graph of Chlorophyll b vs. Time for the Narrows Site-May.

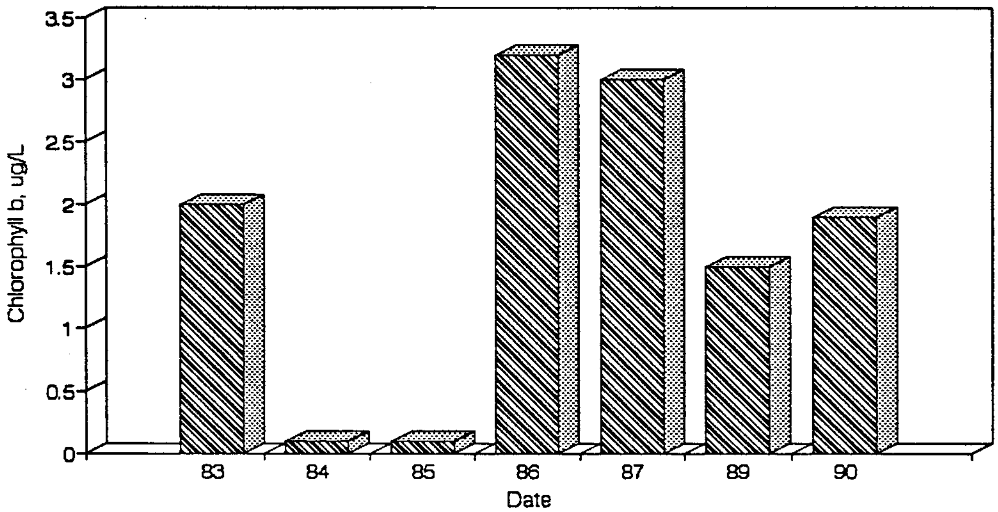

Figure F11. Graph of Chlorophyll b vs. Time for the Narrows Site-Aug.

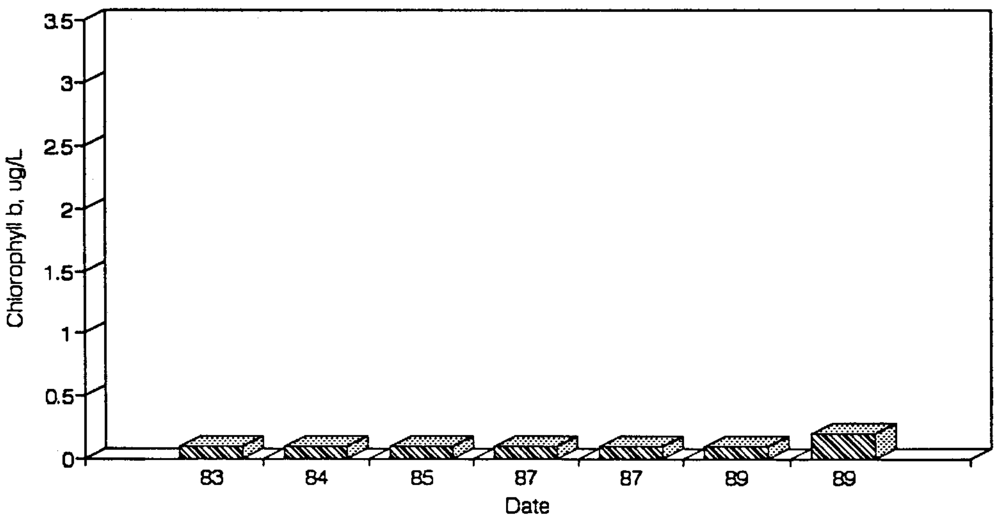

Figure F12. Graph of Chlorophyll b vs. Time for the Narrows Site-Dec.

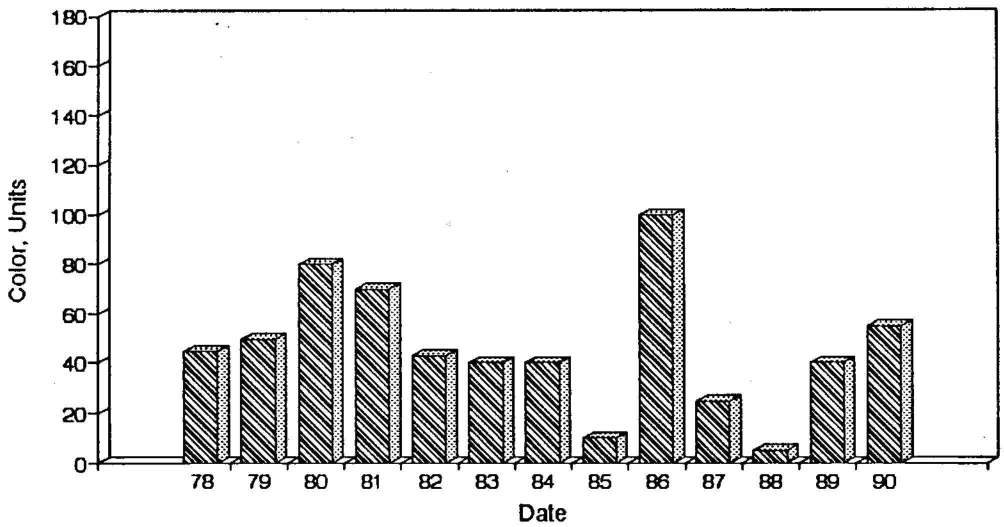

Figure F13. Graph of Color vs. Time for the Narrows Site-May.

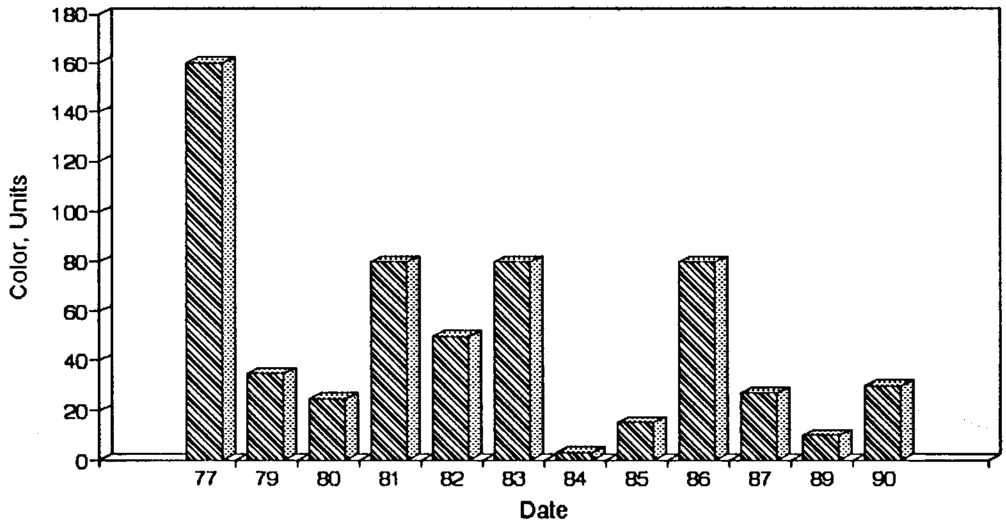

Figure F14. Graph of Color vs. Time for the Narrows Site-Aug.

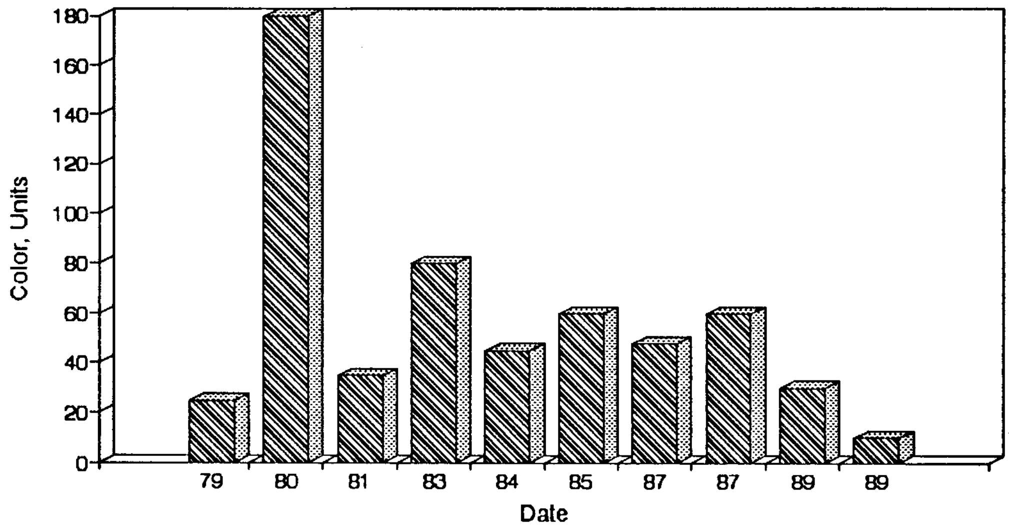

Figure F15. Graph of Color vs. Time for the Narrows Site-Dec.

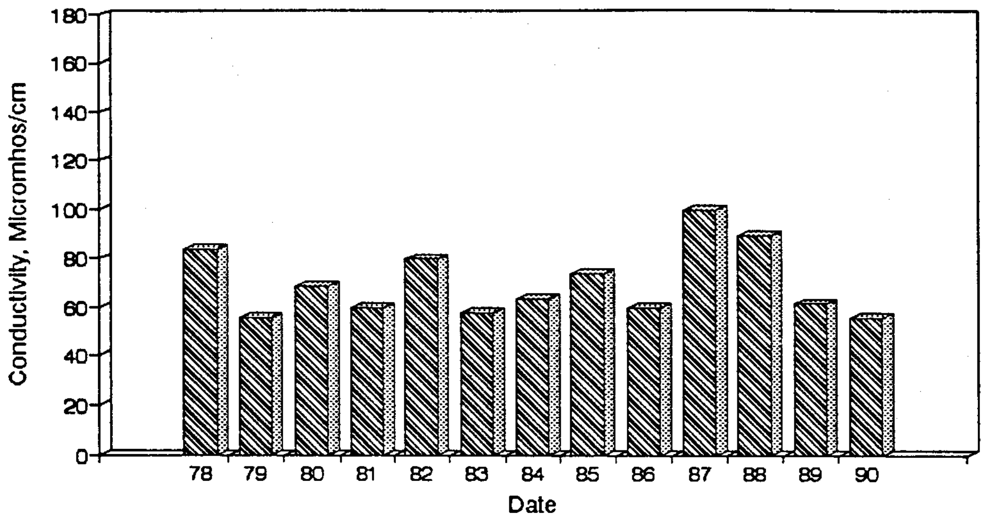

Figure F16. Graph of Conductivity vs. Time for the Narrows Site-May.

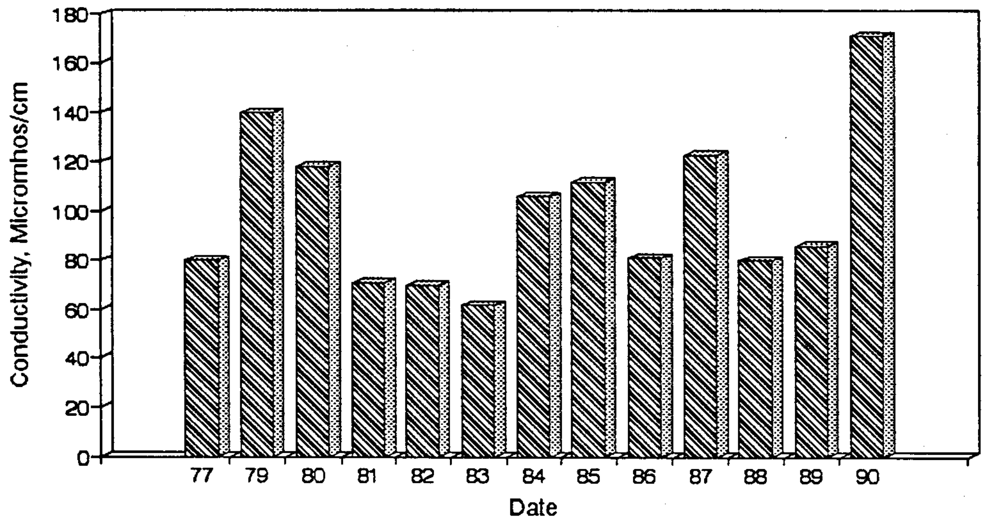

Figure F17. Graph of Conductivity vs. Time for the Narrows Site-Aug.

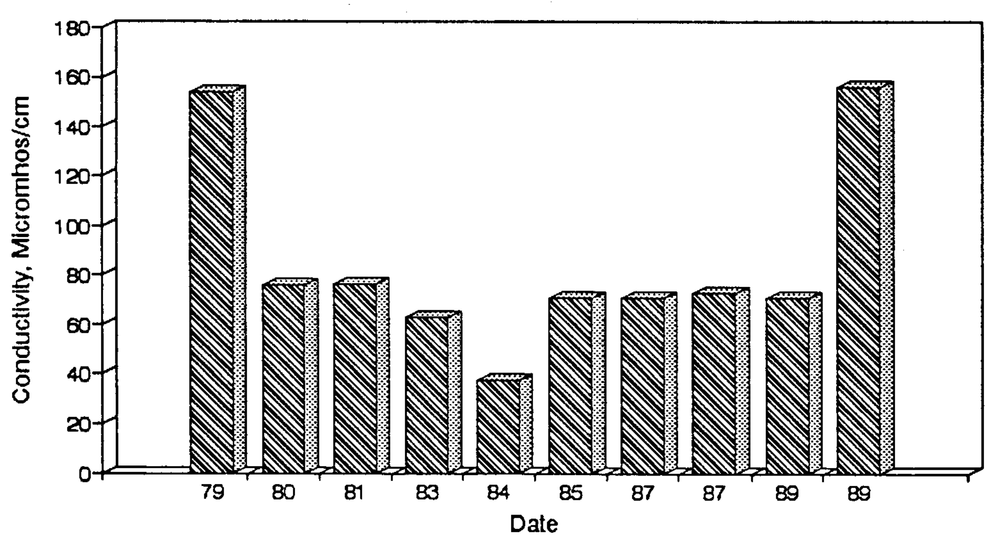

Figure F18. Graph of Conductivity vs. Time for the Narrows Site-Dec.

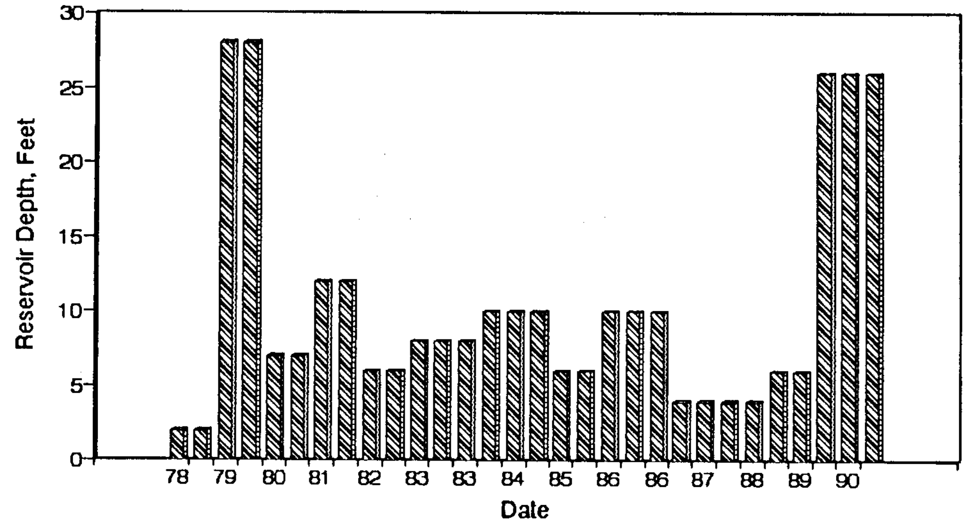

Figure F19. Graph of Reservoir Depth vs. Time for the Narrows Site-May.

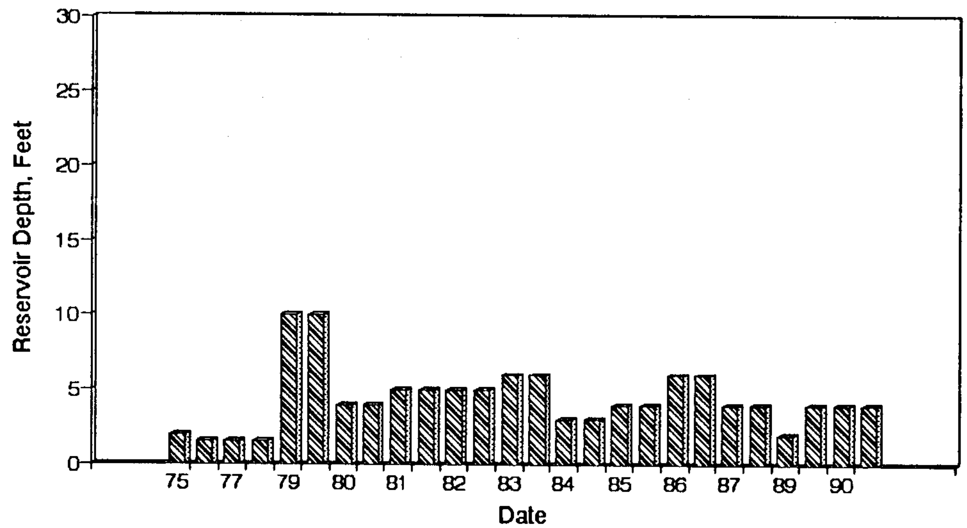

Figure F20. Graph of Reservoir Depth vs. Time for the Narrows Site-Aug.

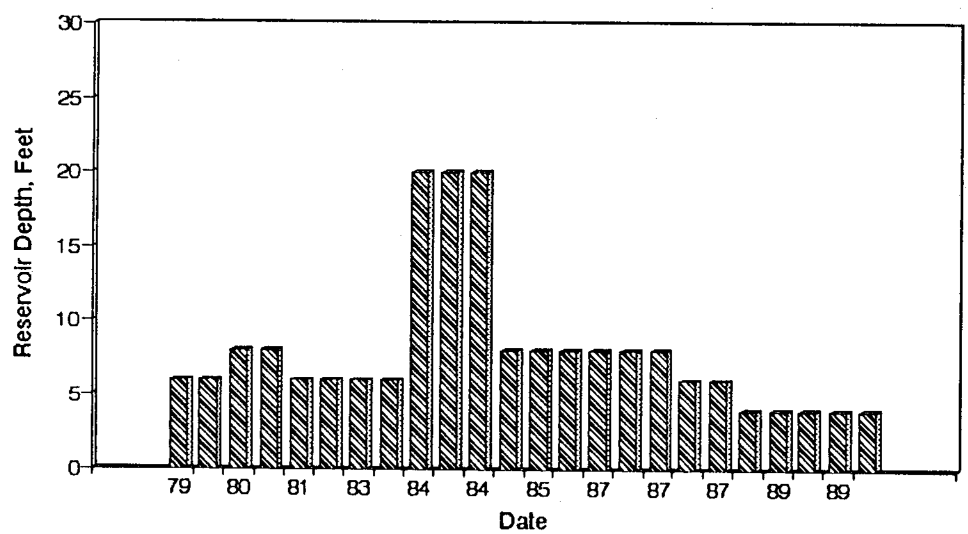

Figure F21. Graph of Reservoir Depth vs. Time for the Narrows Site-Dec.

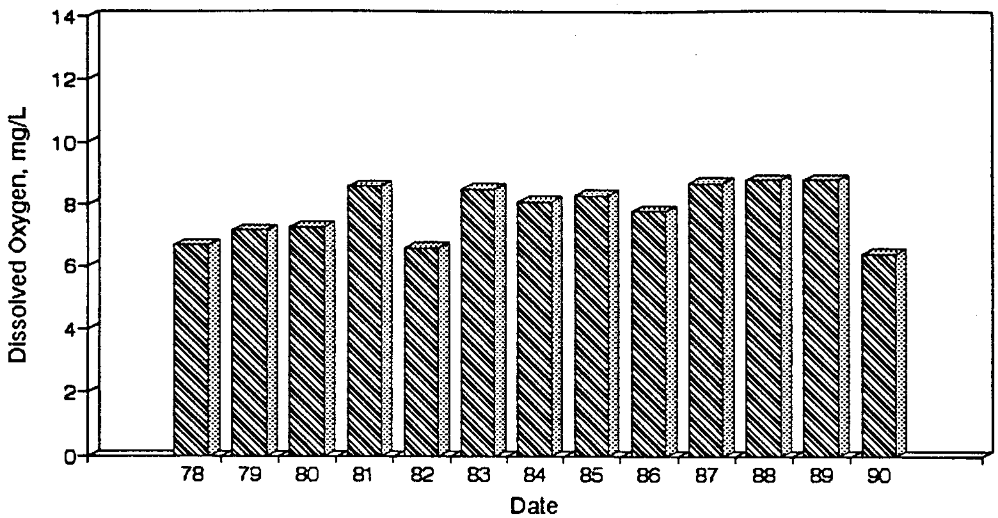

Figure F22. Graph of Dissolved Oxygen vs. Time for the Narrows Site-May.

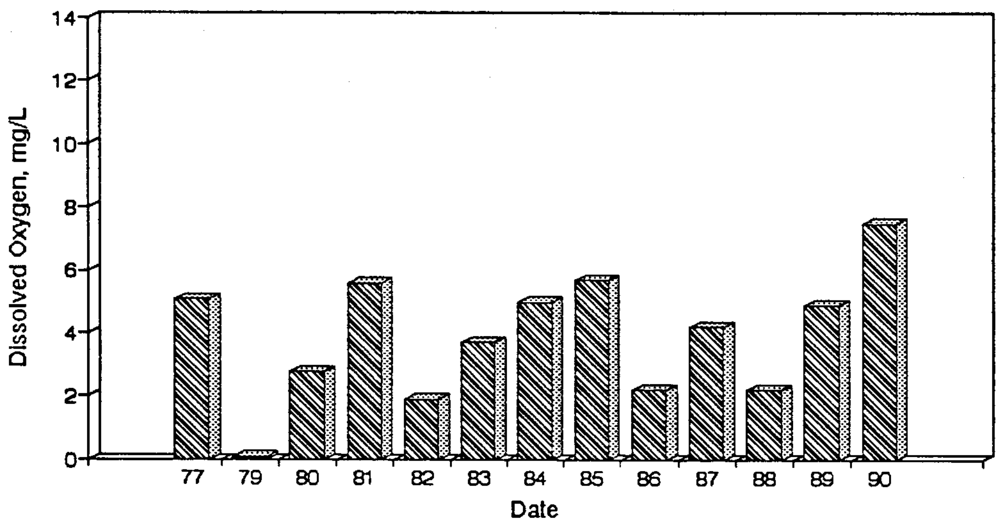

Figure F23. Graph of Dissolved Oxygen vs. Time for the Narrows Site-Aug.

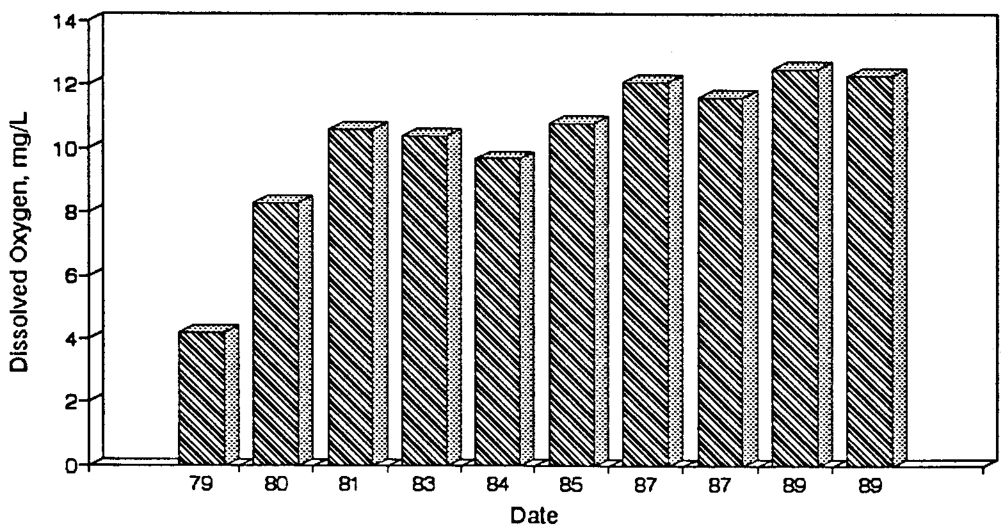

Figure F24. Graph of Dissolved Oxygen vs. Time for the Narrows Site-Dec.

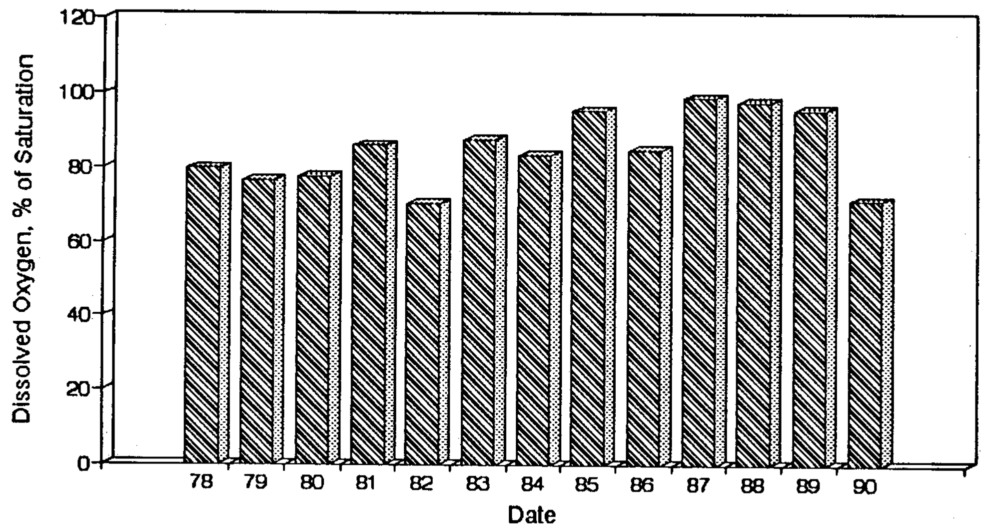

Figure F25. Graph of Dissolved Oxygen vs. Time for the Narrows Site-May.

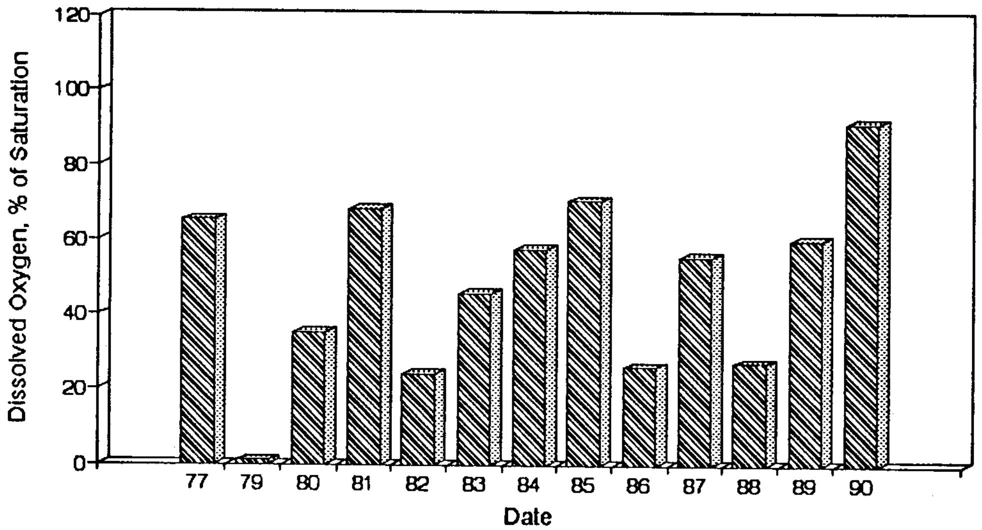

Figure F26. Graph of Dissolved Oxygen vs. Time for the Narrows Site-Aug.

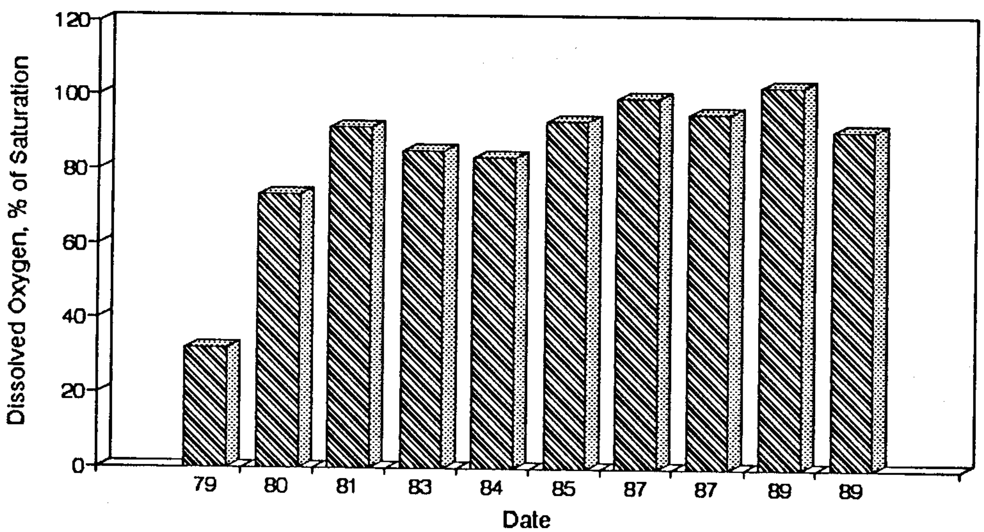

Figure F27. Graph of Dissolved Oxygen vs. Time for the Narrows Site-Dec.

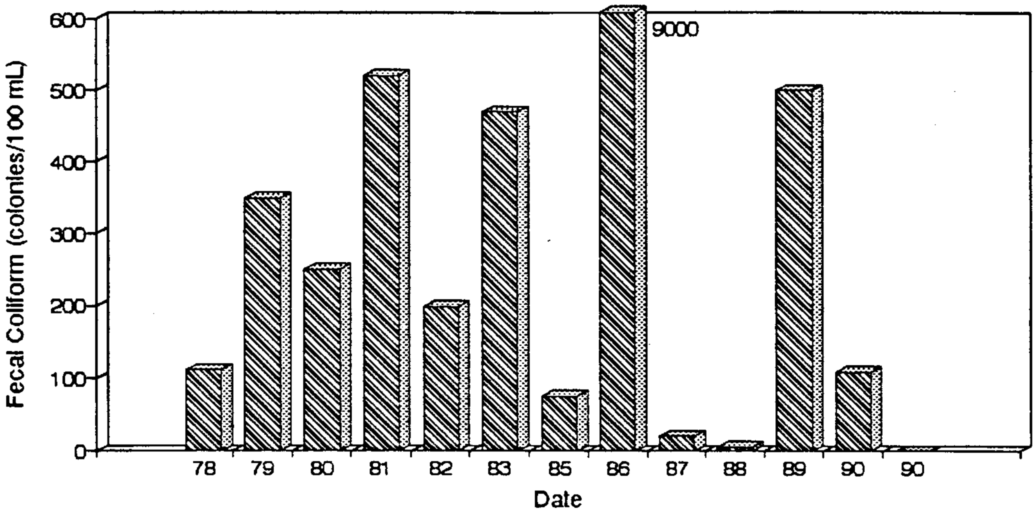

Figure F28. Graph of Fecal Coliform vs. Time for the Narrows Site-May.

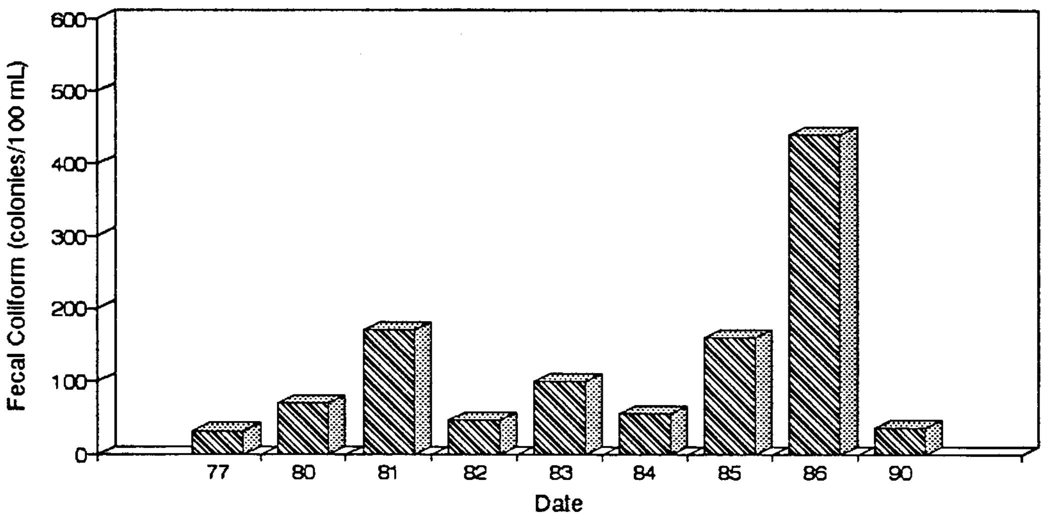

Figure F29. Graph of Fecal Coliform vs. Time for the Narrows Site-Aug.

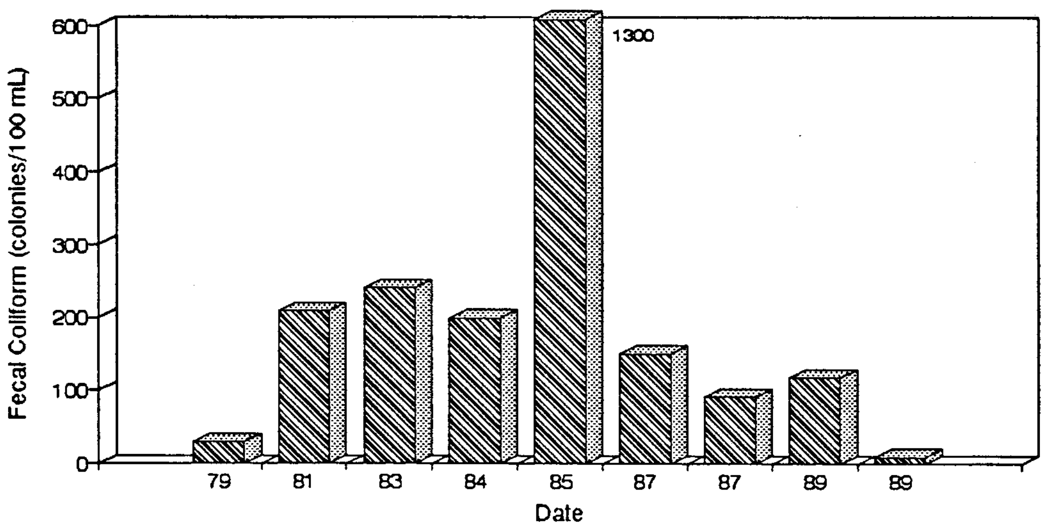

Figure F30. Graph of Fecal Coliform vs. Time for the Narrows Site-Dec.

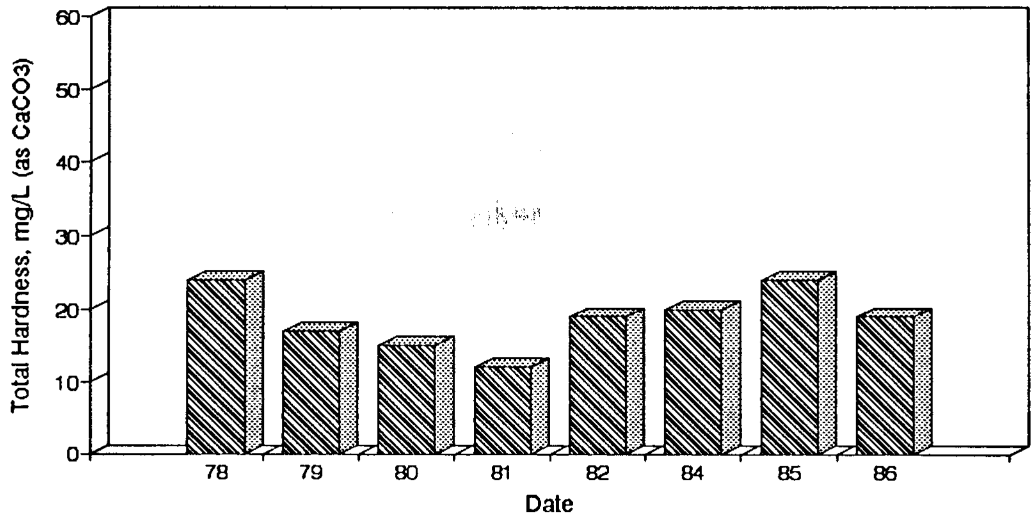

Figure F31. Graph of Total Hardness vs. Time for the Narrows Site-May.

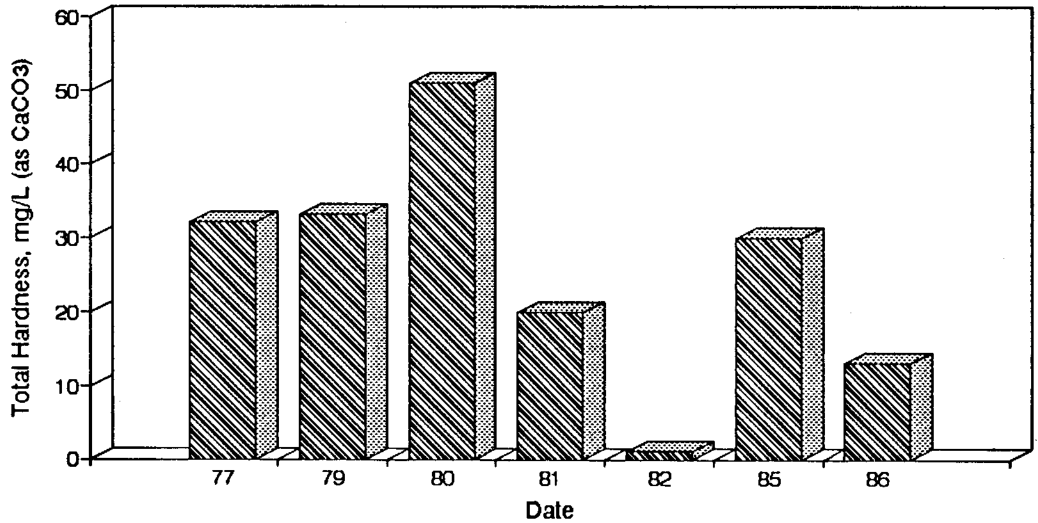

Figure F32. Graph of Total Hardness vs. Time for the Narrows Site-Aug.

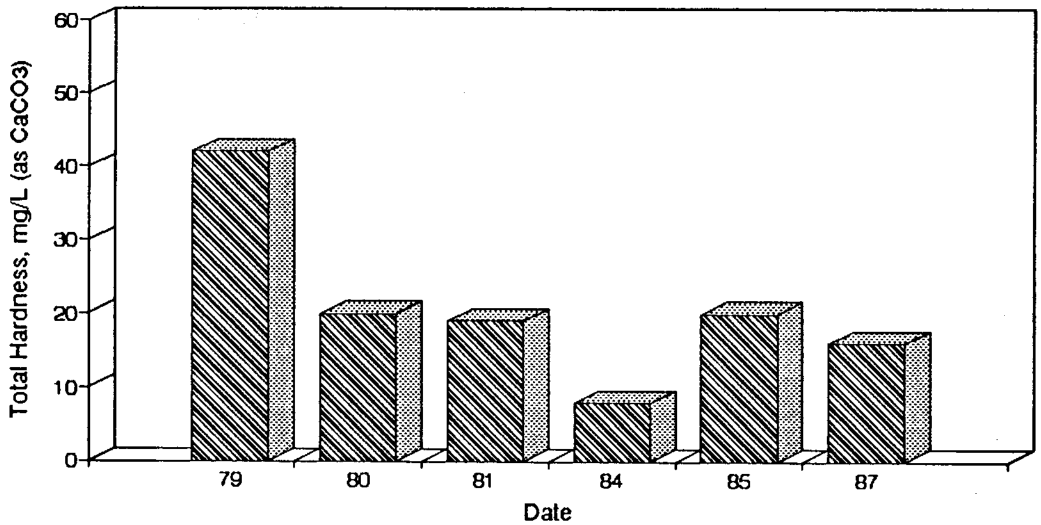

Figure F33. Graph of Total Hardness vs. Time for the Narrows Site-Dec.

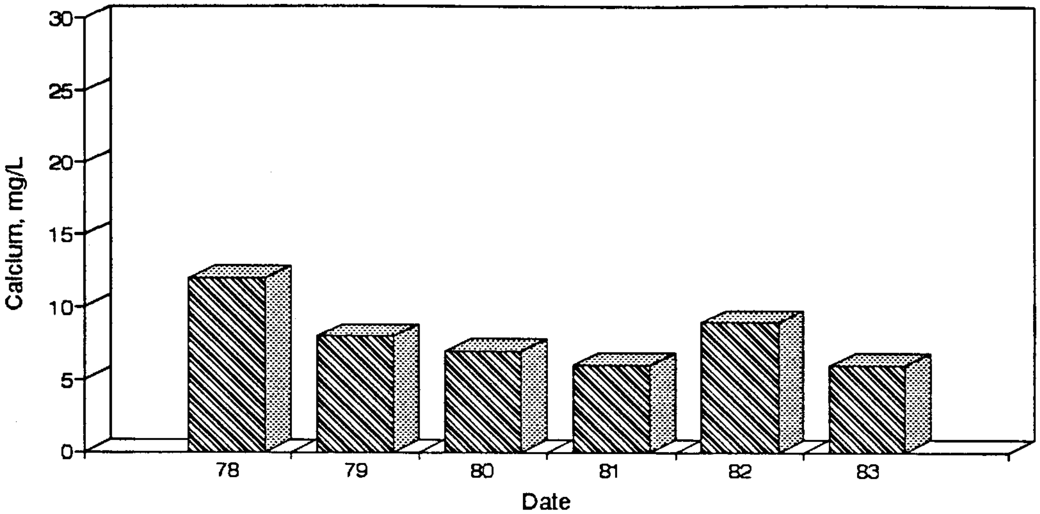

Figure F34. Graph of Calcium vs. Time for the Narrows Site-May.

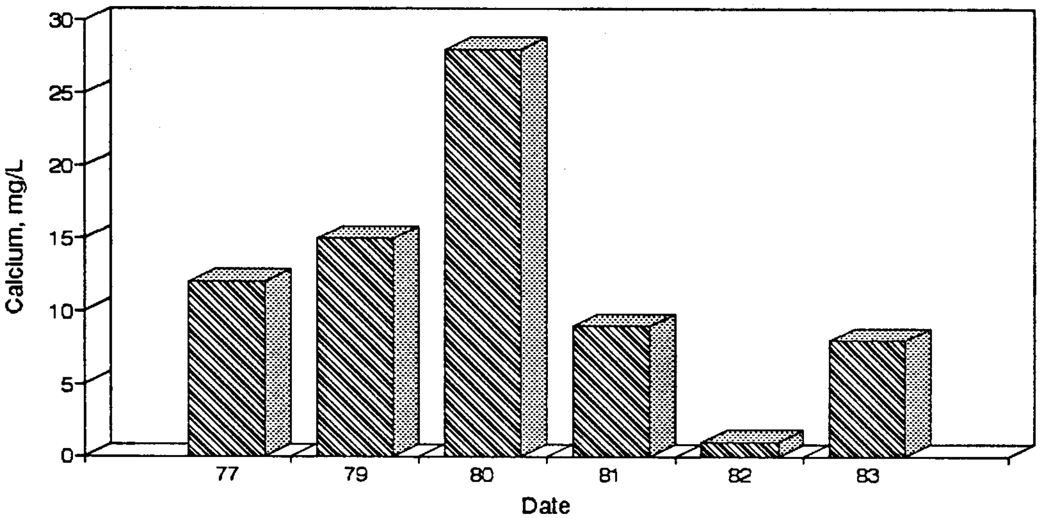

Figure F35. Graph of Calcium vs. Time for the Narrows Site-Aug.

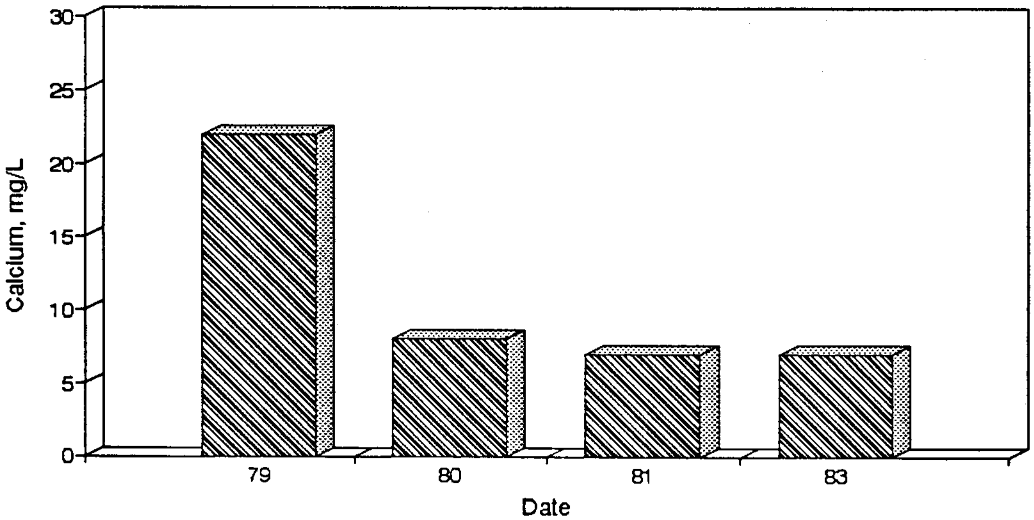

Figure F36. Graph of Calcium vs. Time for the Narrows Site-Dec.

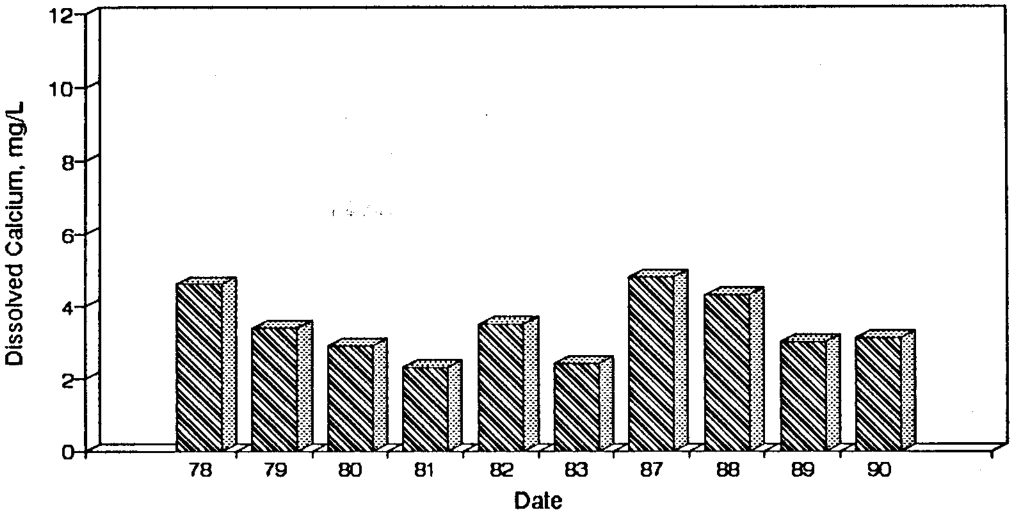

Figure F37. Graph of Dissolved Calcium vs. Time for the Narrows Site-May.

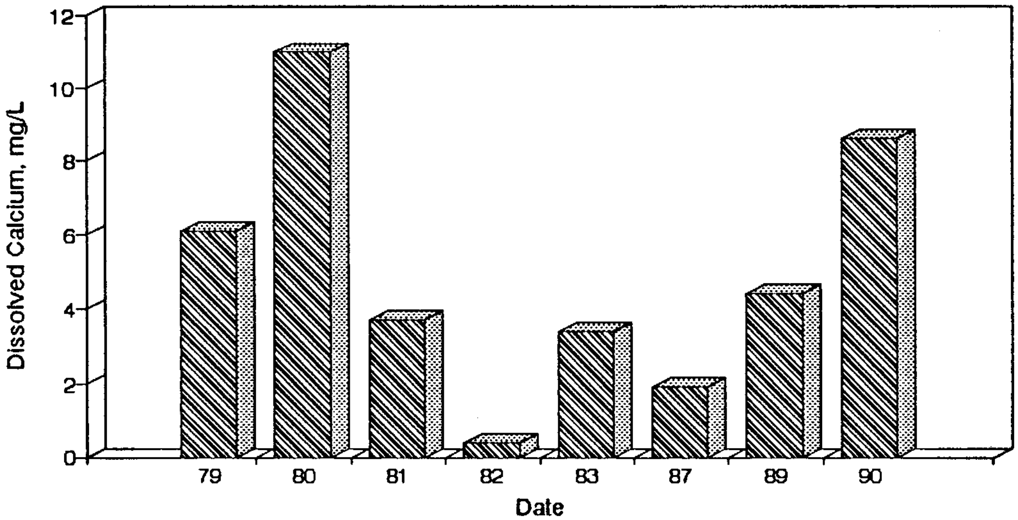

Figure F38. Graph of Dissolved Calcium vs. Time for the Narrows Site-Aug.

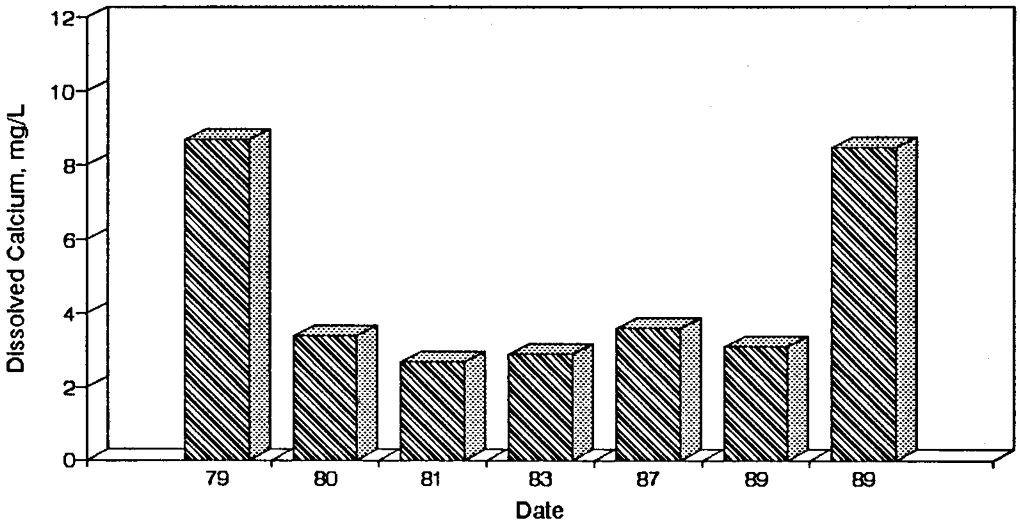

Figure F39. Graph of Dissolved Calcium vs. Time for the Narrows Site-Dec.

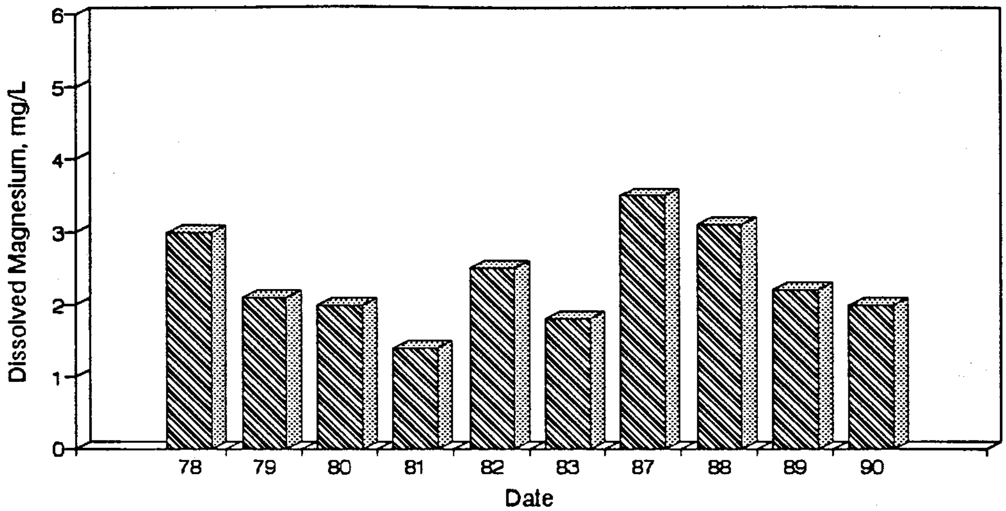

Figure F40. Graph of Dissolved Magnesium vs. Time for the Narrows Site-May.

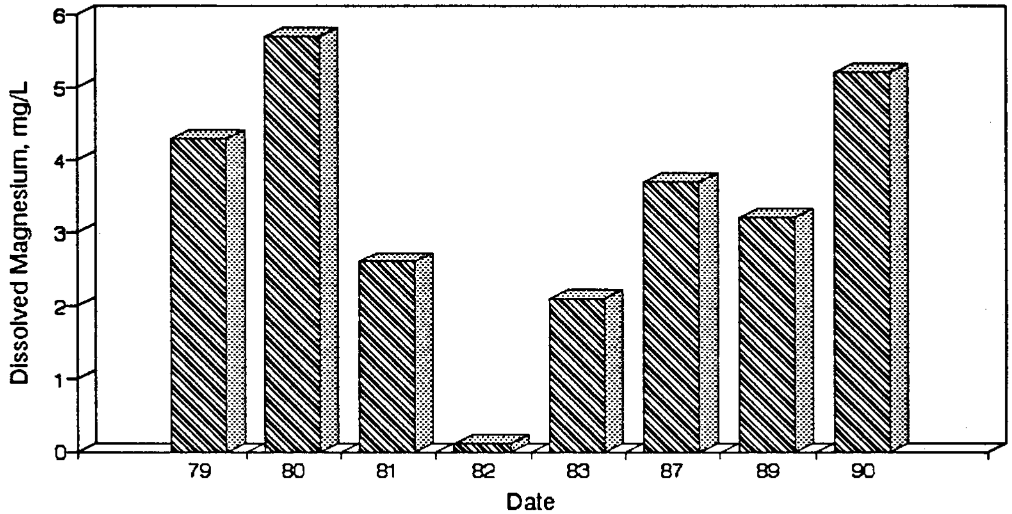

Figure F41. Graph of Dissolved Magnesium vs. Time for the Narrows Site-Aug.

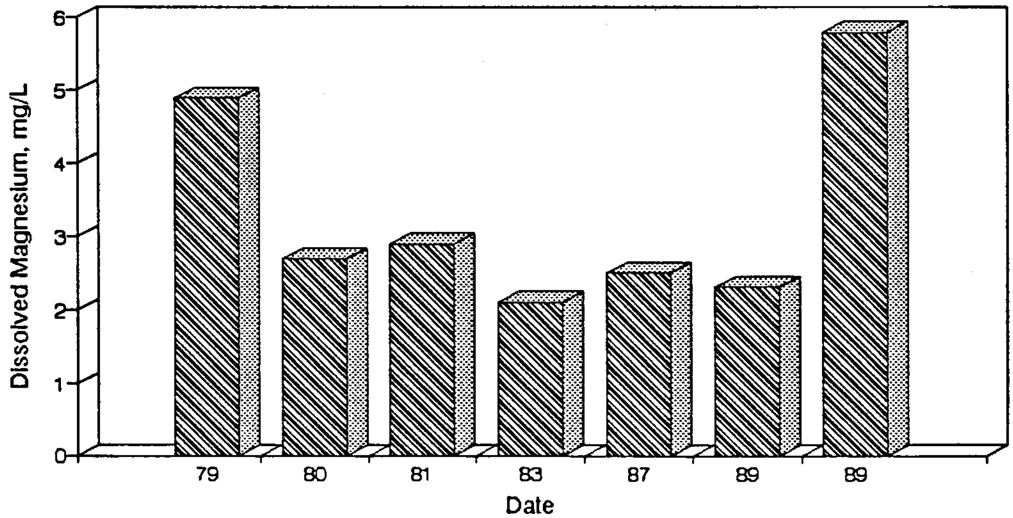

Figure F42. Graph of Dissolved Magnesium vs. Time for the Narrows Site-Dec.

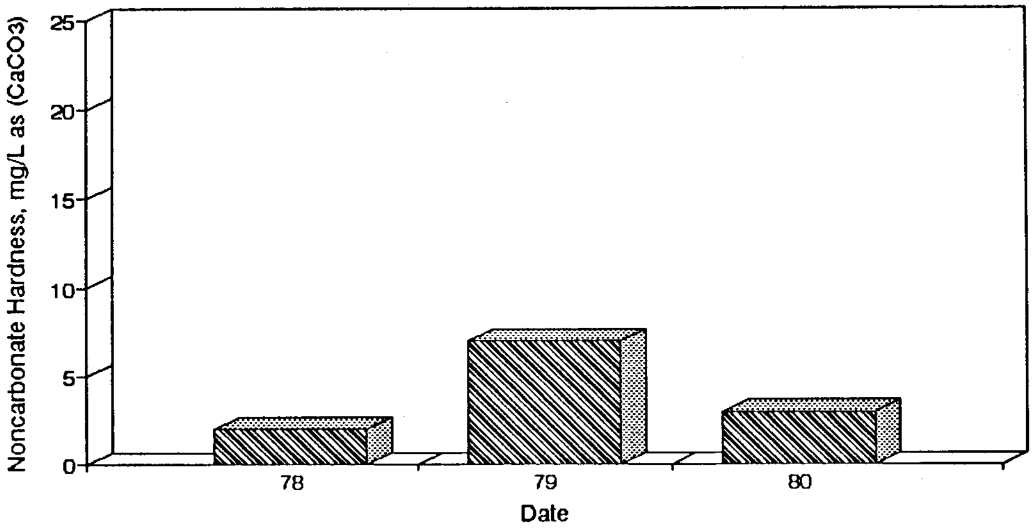

Figure F43. Graph of Noncarbonate Hardness vs. Time for the Narrows Site-May.

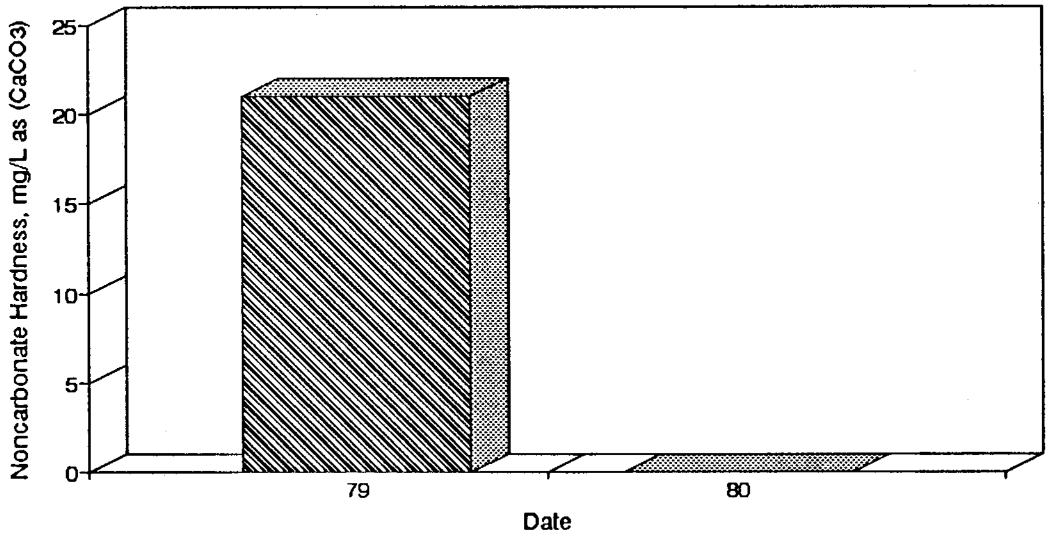

Figure F44. Graph of Noncarbonate Hardness vs. Time for the Narrows Site-Aug.

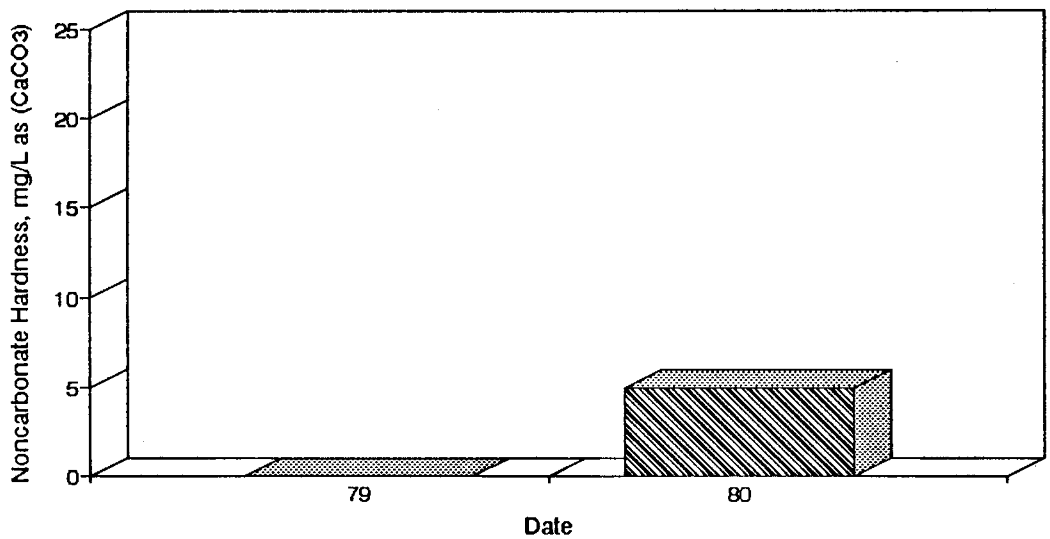

Figure F45. Graph of Noncarbonate Hardness vs. Time for the Narrows Site-Dec.

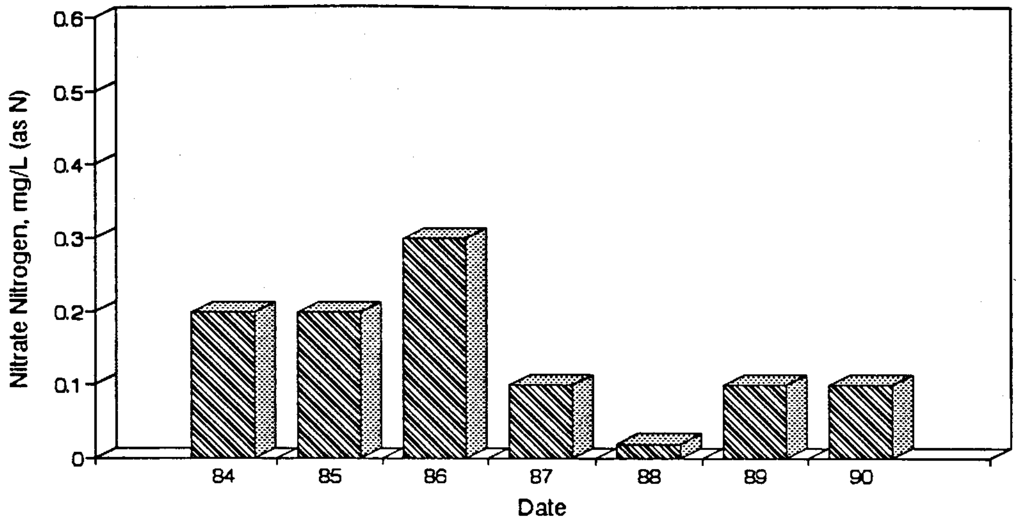

Figure F46. Graph of Nitrate Nitrogen vs. Time for the Narrows Site-May.

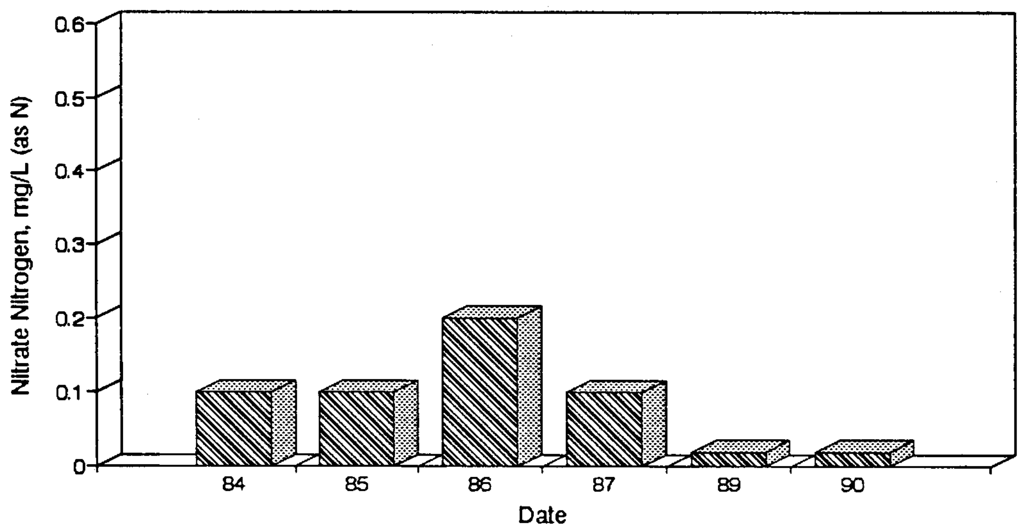

Figure F47. Graph of Nitrate Nitrogen vs. Time for the Narrows Site-Aug.

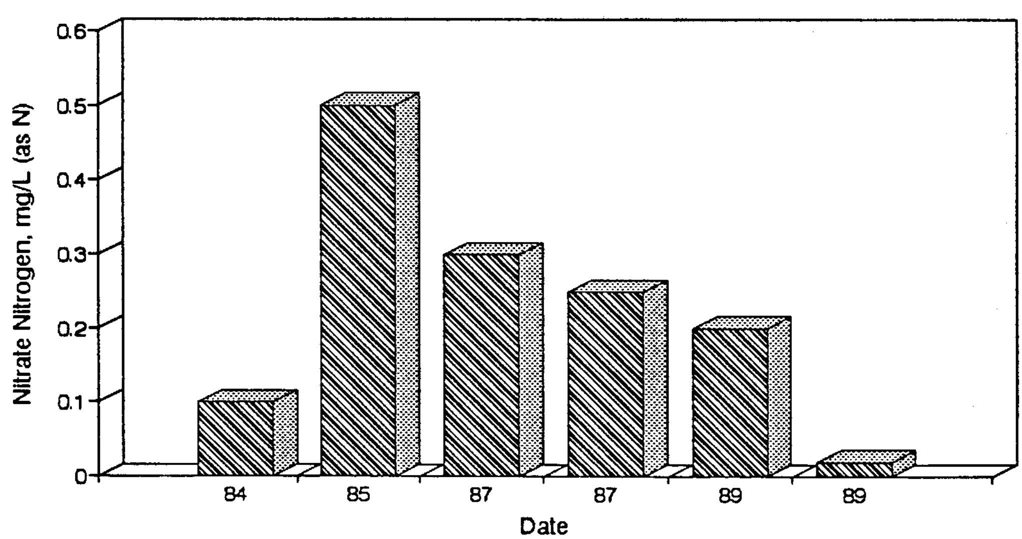

Figure F48. Graph of Nitrate Nitrogen vs. Time for the Narrows Site-Dec.

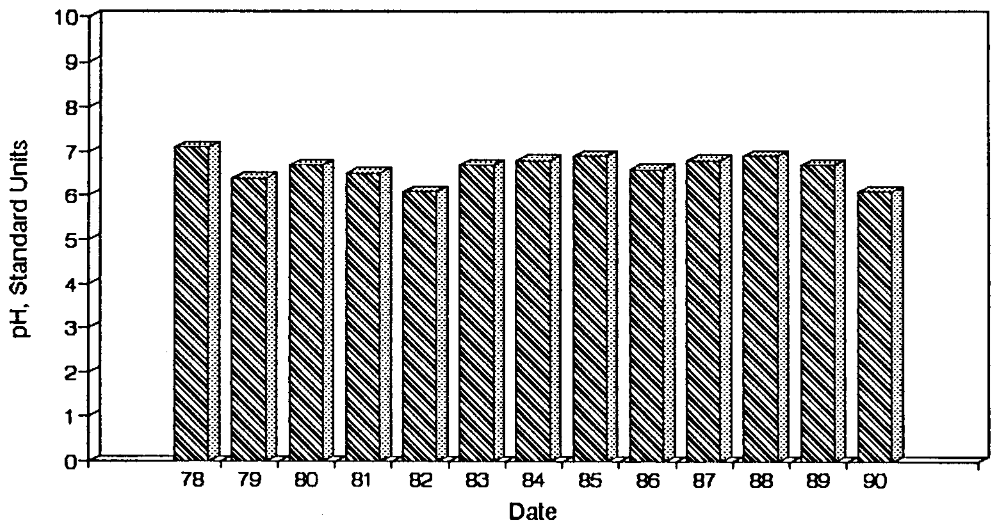

Figure F49. Graph of pH vs. Time for the Narrows Site-May.

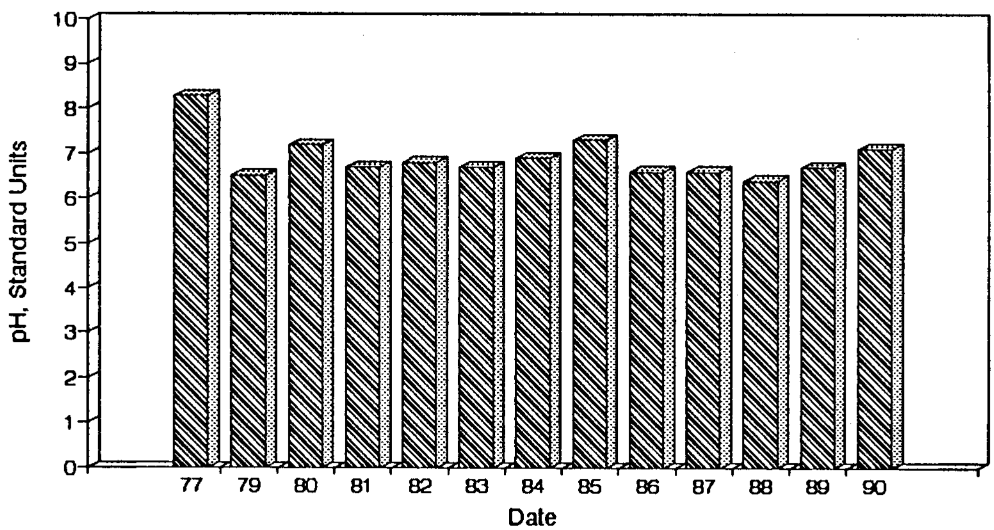

Figure F50. Graph of pH vs. Time for the Narrows Site-Aug.

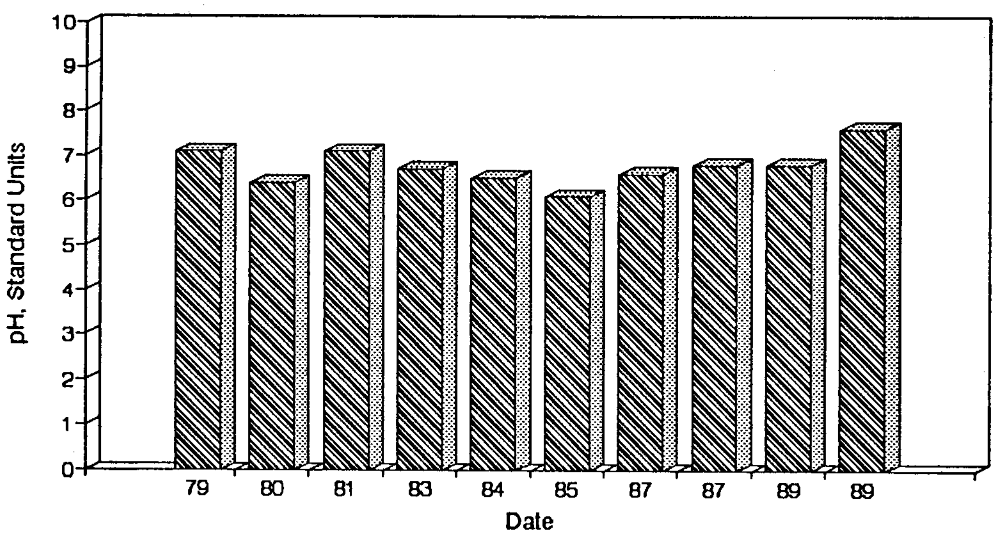

Figure F51. Graph of pH vs. Time for the Narrows Site-Dec.

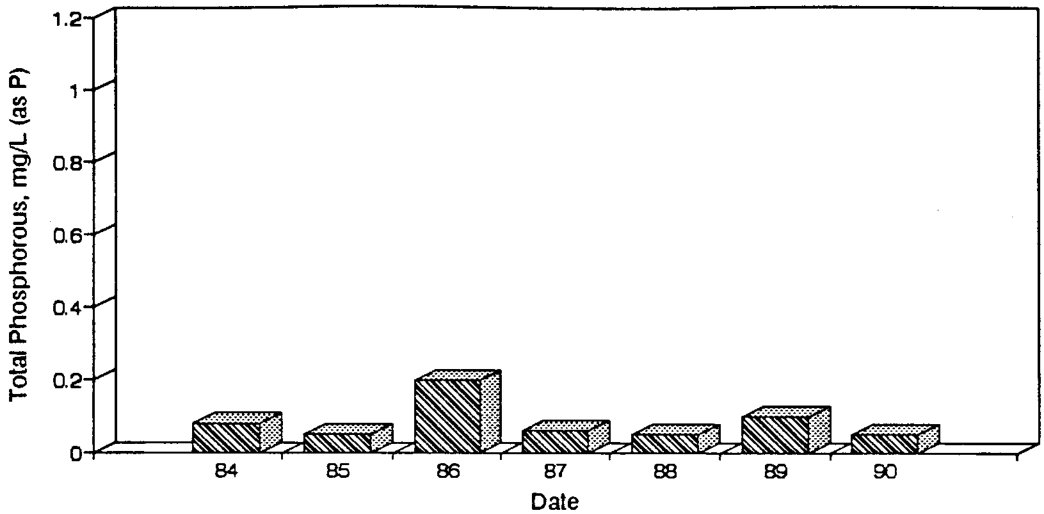

Figure F52. Graph of Total Phosphorous vs. Time for the Narrows Site-May.

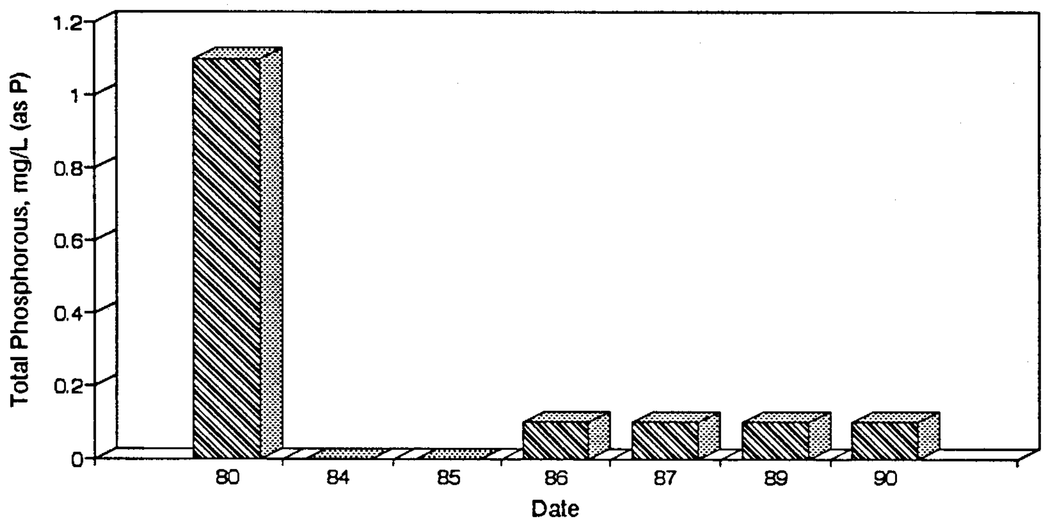

Figure F53. Graph of Total Phosphorous vs. Time for the Narrows Site-Aug.

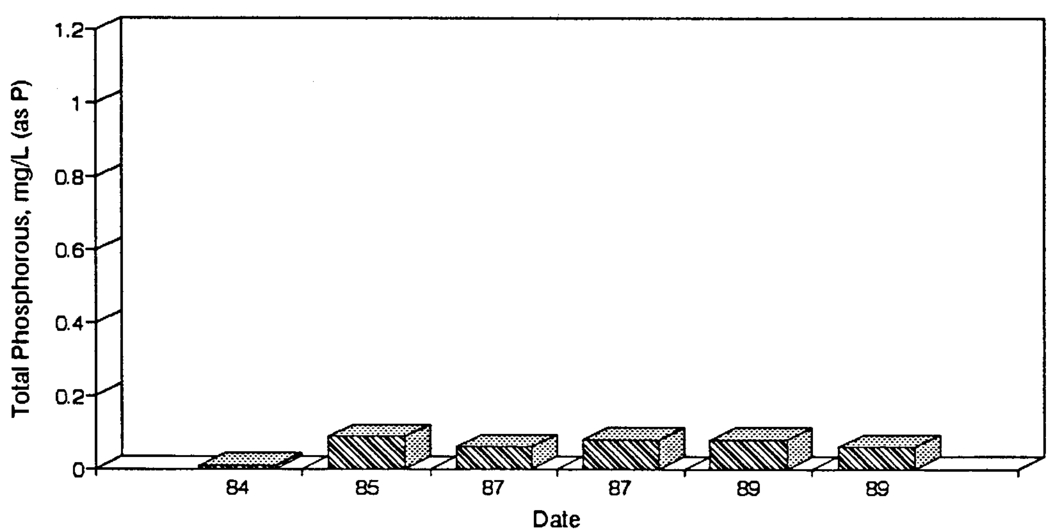

Figure F54. Graph of Total Phosphorous vs. Time for the Narrows Site-Dec.

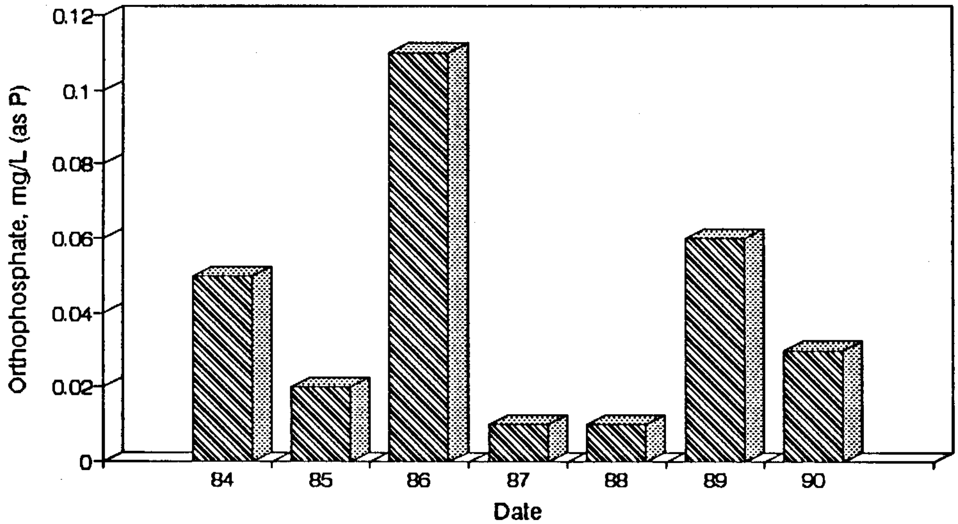

Figure F55. Graph of Orthophosphate vs. Time for the Narrows Site-May.

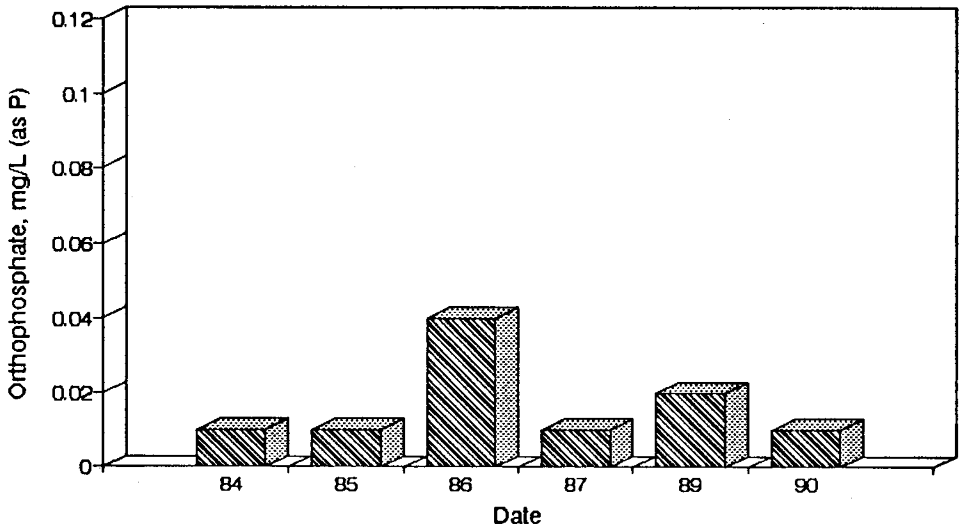

Figure F56. Graph of Orthophosphate vs. Time for the Narrows Site-Aug.

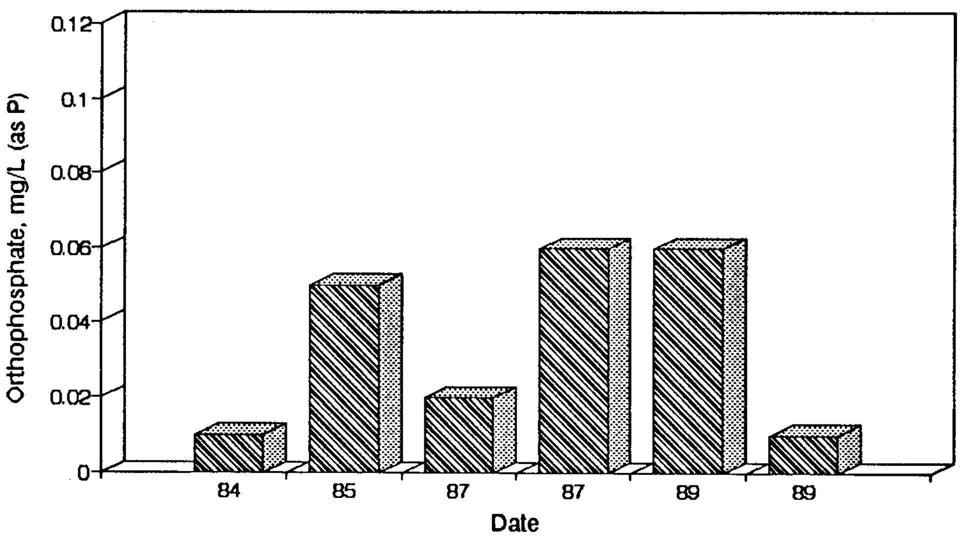

Figure F57. Graph of Orthophosphate vs. Time for the Narrows Site-Dec.

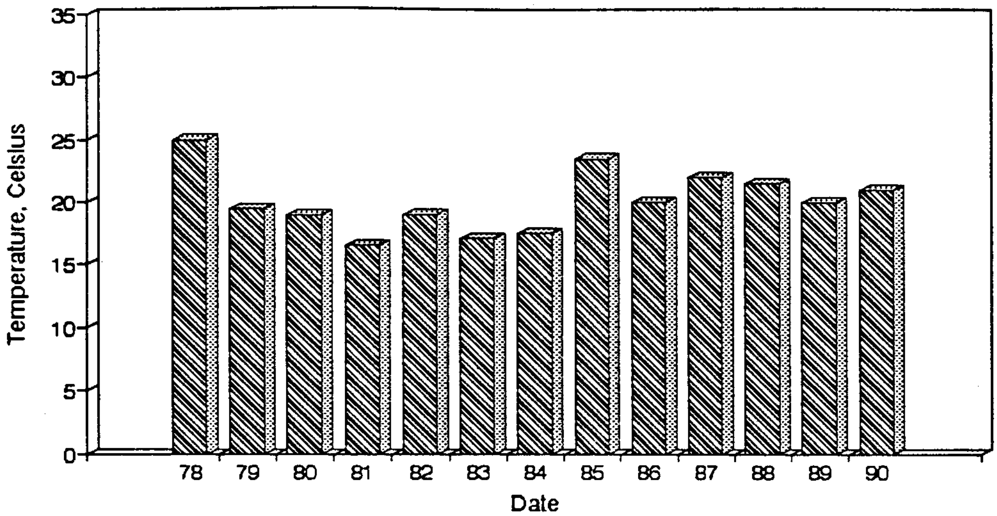

Figure F58. Graph of Temperature vs. Time for the Narrow Site-May.

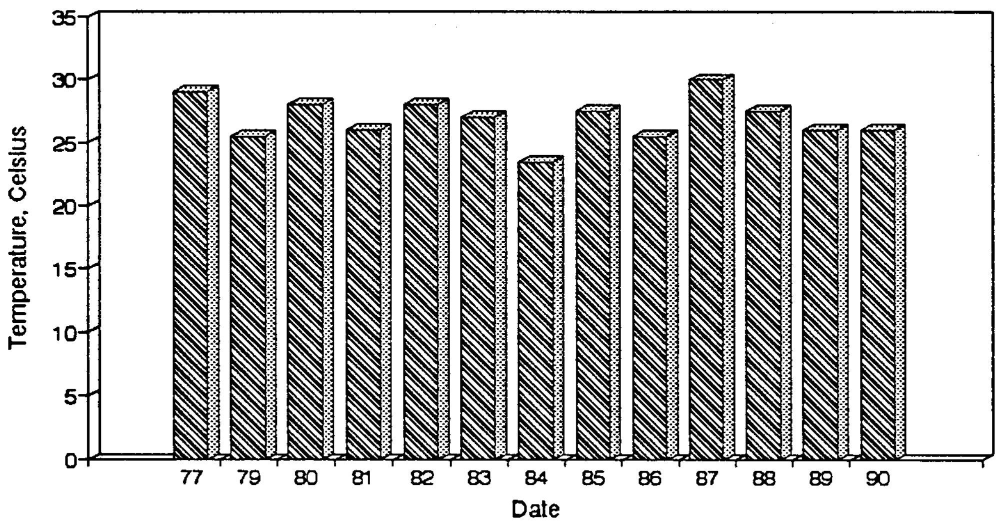

Figure F59. Graph of Temperature vs. Time for the Narrows Site-Aug.

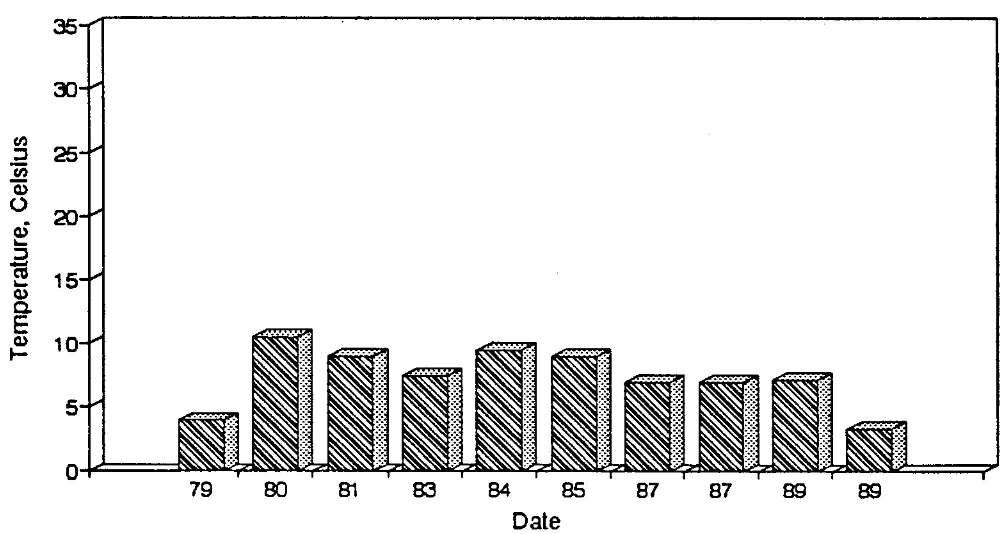

Figure F60. Graph of Temperature vs. Time for the Narrows Site-Dec.

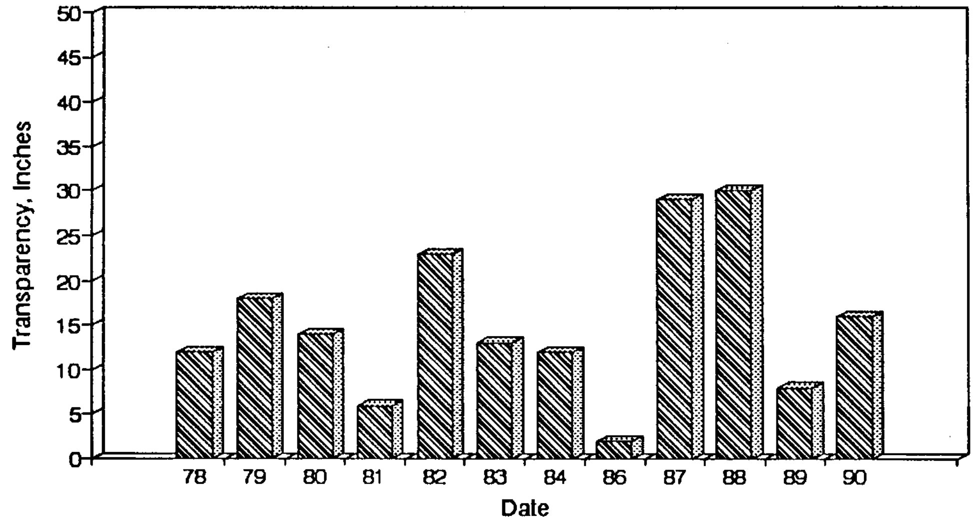

Figure F61. Graph of Transparency vs. Time for the Narrows Site-May.

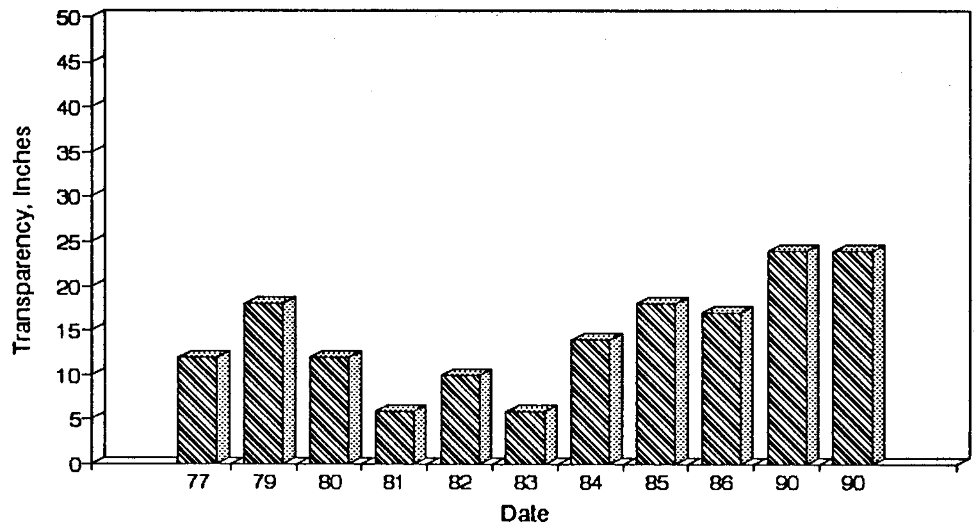

Figure F62. Graph of Transparency vs. Time for the Narrows Site-Aug.

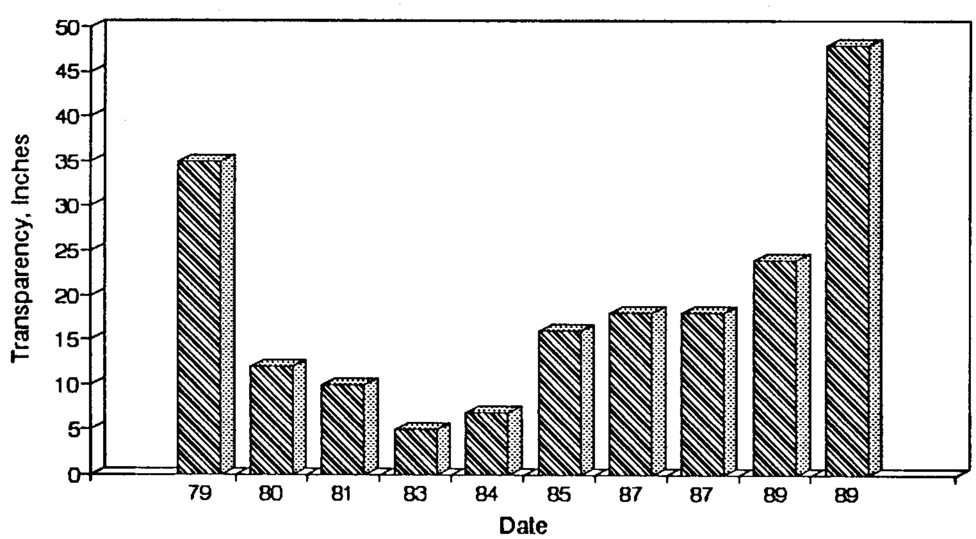

Figure F63. Graph of Transparency vs. Time for the Narrows Site-Dec.

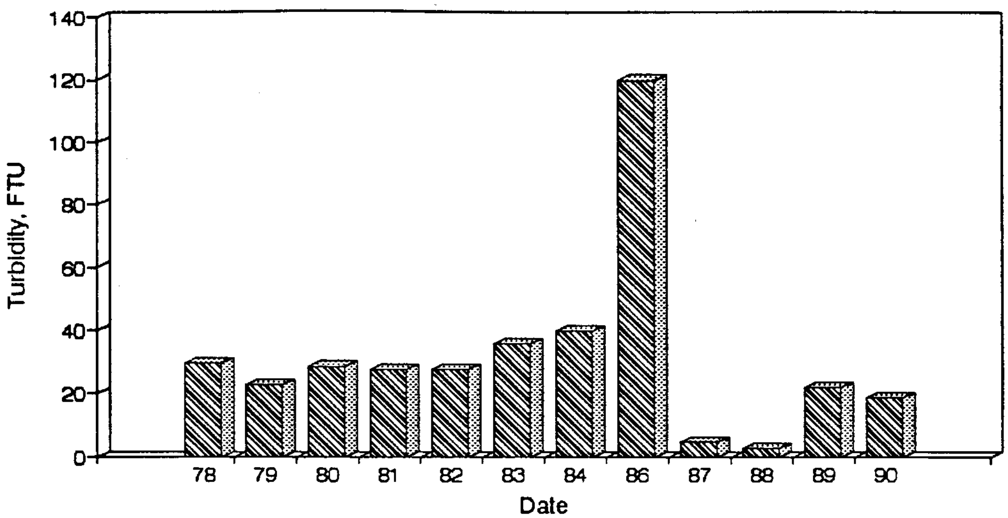

Figure F64. Graph of Turbidity vs. Time for the Narrows Site-May.

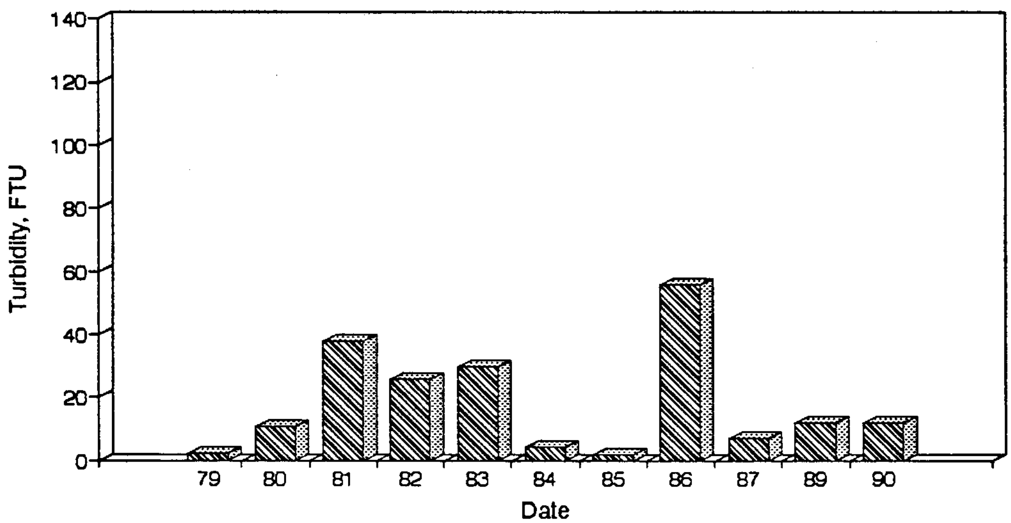

Figure F65. Graph of Turbidity vs. Time for the Narrows Site-Aug.

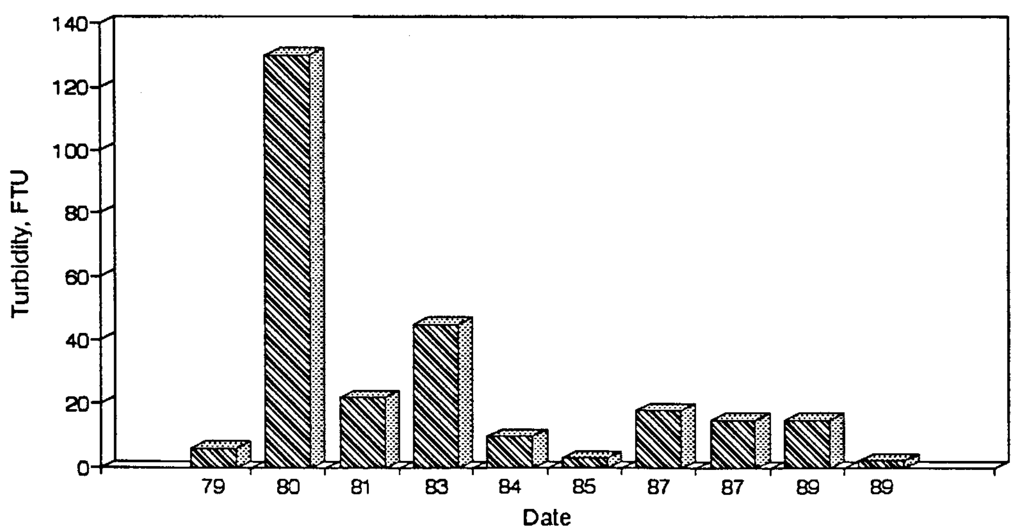

Figure F66. Graph of Turbidity vs. Time for the Narrows Site-Dec.